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PICKERING NGS 'B'
UNITS 6, 7 and 8 CCW
PUMPSET VIBRATION

Report No. 86-333-K

R.B. Jay & W.D. Morgan
Plant Equipment Dynamics Section
Mechanical Research Department

ABSTRACT

Assistance in the commissioning of the pumpsets and their vibration monitoring systems is described. Stiffening of the pumpset/support to avoid a resonance at the blade passing frequency resulted in low vibration levels well within the limit of 5 mm/s.

job	file	date	report no.
27-102-452	825.4	March 6, 1987	86-333-K

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EXECUTIVE SUMMARY

PICKERING NGS 'B' UNITS 6, 7 and 8 - CCW PUMPSET VIBRATION

R.B. Jay & W.D. Morgan
Plant Equipment Dynamics Section
Mechanical Research Dept

OHR assisted in the commissioning of the pumpsets and their vibration monitoring systems. Stiffening of the pumpset/support to avoid a resonance condition at the blade passing frequency of 13.87 Hz, pioneered in Unit 5, was also done on these Units.

Vibration levels of all modified pumpsets for which data are available were all within the limit of 5 mm/s specified in the Station Operating Manual for both motor and pump.

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27-102-452	825.4	March 6, 1987	86-333-K

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To Mr. K. Talbot
Commissioning Manager
Pickering NGS 'B'

PICKERING NGS 'B' UNIT 6, 7, AND 8 CCW PUMPSET VIBRATION

1.0 INTRODUCTION

Assistance was given to station personnel during commissioning of CCW Pumpsets and their associated vibration monitoring systems. The principal objectives were:

1.1 To evaluate the acceptability of pumpset vibration and dynamic characteristics with respect to specifications and/or industry standards.

1.2 To make recommendations for reducing pumpset vibration levels if in excess of limits specified in relevant tendering documents or specifications.

1.3 When necessary, to calibrate vibration sensors.

1.4 To check out, set up and calibrate the vibration monitoring circuits associated with each pumpset.

In Unit 5 the overall vibration levels at the top of the motor of both pumpsets exceeded the maximum of 75 μm specified in the tendering documents/3/. The cause was pumpset/support natural frequencies of 12.75 and 14.5 Hz, just below and above the pump blade passing frequency of 13.87 Hz. Raising these natural frequencies by increasing the pumpset/support stiffness as described in/1/ caused the overall vibration to be reduced and well below 75 μm/1 and 3/.

The pumpset/support stiffnesses of the pumpsets of Units 6, 7 and 8 were increased in the same way and what follows relates to the modified pumpsets.

A brief description of the CCW pumpset is given in Reference 1.

2.0 VIBRATION MONITORING INSTRUMENTATION

For a description of the Vibration Monitoring System and more detailed specifications of the sensors itemized below refer to Reference 2.

2.1 Sensors

2.1.1 Velocity (Seismic)

One velocity transducer is mounted at the top of the motor, Figure 1. Provision is made for directing the sensitive axis vertically, or relative to the pumpset axis, radially or tangentially. The radial direction has been adopted.

Another velocity transducer is mounted on the pump, Figure 1, with its sensitive axis directed radially.

The velocity transducers are Metrix, Model 5166-04, stock code 641A1114.

2.1.2 Phase Marker

The phase marker is an Atlas Electronics electro-magnetic pickup, Part No 725148, stock code 742 B 8953.

Its orientation and mounting are shown in Figure 1.

2.2 Calibrations

2.2.1 Velocity (Seismic) Transducers

Velocity transducers cannot be satisfactorily calibrated in the field. Although equipment is available for checking the sensitivity at a specific frequency, this is not always satisfactory since changes in the overall frequency response can and do occur which could remain undetected.

The velocity transducers were calibrated by the manufacturer. The calibration test data are attached to a copy of manual NK30-WAH-60436-9009, assigned to Mr. S.S. Grewal of Pickering NGS 'B'.

2.2.2 Circuit Calibrations

Single point circuit calibrations as described in Reference 2 were performed for all pumpsets. For normal VMS operation, the nominal full scale ranges selected in the Unit Computer and by

pin jacks on the seismic circuit boards are 17 mm/s pk for YE1 and 56.6 mm/s for YE2. These correspond to the M (medium) and L (low) gain settings respectively, and were used for the calibrations. For circuits with full scale ranges of 17 mm/s the calibration input voltage was 20 mV rms and for the circuit with a 56.6 mm/s full scale range, 67 mV rms. For a velocity transducer sensitivity of 3.35 mV/mm/s these calibration voltages correspond to computer readouts of 8.45 and 28.3 mm/s peak, respectively. the following computer readouts were obtained.

Computer Readouts for Calibration Inputs Equivalent to 8.45 mm/s (YE1) and 28.3 mm/s (YE2)

UNIT 6		
Pumpset No.	1	2
Top of Motor (YE1)	8.66	8.42
Pump (YE2)	28.15	28.10

UNIT 7		
Pumpset No.	1	2
Top of Motor (YE1)	8.45	8.45
Pump (YE2)	28.36	28.33

UNIT 8		
Pumpset No.	1	2
Top of Motor (YE1)	8.48	8.48
Pump (YE2)	28.36	28.31

2.3 Full Scale Range Settings

The ranges found most suitable for operational use were the same as those used for the circuit calibrations above ie

Top of Motor (YE1) : 17 mm/s
Pump (YE2) : 56.6 mm/s

2.4 Vibration Alarms

2.4.1 Alarm Setting

The alarm function is performed by the Unit Computer. Refer to relevant Station information and procedures for setting the alarm levels.

2.4.2 Alarm Limits

The tendering document/3/ states "The maximum allowable amplitude of overall vibration measured at the top of the motor is 3.0 mils p-p in any direction for normal operating conditions".

The VMS measures, and the computer alarms on, velocity measurements. At the pumpset speed of 195 rpm (3.25 Hz) the equivalent vibration velocity is 0.76 mm/s. At 13.87 Hz, the blade passage frequency, the equivalent vibration velocity is 3.3 mm/s. On a General Machinery Vibration Chart these velocities correspond to ratings of 'good' and between 'fair' and 'slightly rough'.

The Station Operating manual specifies the following alarm limits:

Top of Motor (YE1) : 5 mm/s pk
Pump Bowl (YE2) : 5 mm/s pk

3.0 PUMPSET COMMISSIONING TESTS

3.1 Check for Structural Resonances

Modifications were made to the pumpsets of Unit 5 to move structural natural frequencies so as to avoid a resonance condition at the pump blade passage frequency/1/. These same modifications were incorporated in the pumpsets of Units 6, 7 and 8. Operational checks of these pumpsets revealed acceptable vibration levels obviating the need for further shaker tests to determine structural natural frequencies.

3.2 Vibration at Full Unit Load

Six minute trend plots from the computers of Units 6, 7 and 8 are in Appendix A. Typical vibration spectra obtained with a Nicolet dual channel FFT Analyzer from taped records are in Appendices B,C, and D for Units 6, 7 and 8 respectively.

4.0 TAPE RECORDING

Vibration of all operating pumpsets was tape recorded at full Unit load. A log of the recordings is in Appendix E.

5.0 DISCUSSION OF RESULTS

5.1 Vibration at Full Unit Load

5.1.1 Unit 6

The overall vibration velocity data in Appendix A obtained from Unit computer are summarized below.

	VIBRATION VELOCITIES - mm/s			
	MOTOR (YE-1)		PUMP (YE-2)	
PUMPSET	RANGE	AVERAGE	RANGE	AVERAGE
P1	0.37-1.00	0.70	0.25-0.45	0.31
P2	0.34-0.84	0.54	-	-

These values are well within the vibration limits quoted in 2.4.2.

The spectra in Appendix B show that the dominant vibration component at the top of the motor of P1 is at 26.5 Hz while for the motor of pumpset P2 this component is slightly exceeded by one at 30 Hz. In both instances, however, the levels are low and consistent with the average overall levels in the Table above. These two frequencies are close to the pumpset/support natural frequencies of 24.25 Hz in the north-south direction and 30.1 Hz in the east-west direction (see Figs 14 to 17 in/1/).

5.1.2 Unit 7

The overall vibration velocity data in Appendix A are summarized below:

	VIBRATION VELOCITIES - mm/s			
	MOTOR (YE-1)		PUMP (YE-2)	
PUMPSET	RANGE	AVERAGE	RANGE	AVERAGE
P1	0.5-0.84	0.64	0.3-0.42	0.35
P2	0.4-0.96	0.60	0.18-0.35	0.27

These values also are well within the vibration limits quoted in 2.4.2.

The spectra in Appendix C for vibration at the top of the motor are generally similar to those in Appendix B. A notable exception relating to pumpset P2 is an inconsistency between the spectral levels and those in the table above. This is presumed due changed pump operating conditions when the two sets of data were obtained.

5.1.3 Unit 8

Below are summarized the overall vibration velocity data from Appendix A.

	VIBRATION VELOCITIES - mm/s			
	MOTOR (YE-1)		PUMP (YE-2)	
PUMPSET	RANGE	AVERAGE	RANGE	AVERAGE
P1	0.36-0.74	0.56	0.25-0.32	0.28
P2	0.39-0.85	0.58	0.27-0.44	0.34

Again these values are well within the vibration limits quoted in 2.4.2 and the spectra in Appendix D are generally similar to

those in Appendices B & C. The notable exception is the spectrum for the motor of pumpset P2 in which the dominant component is 19.75 Hz rather than 26.5 or 30 Hz as in the spectra examined for pumpsets of other Units.

6.0 CONCLUSIONS AND RECOMMENDATIONS

1. The vibration levels of all pumpsets in Units 7 and 8 are well within the limit of 5 mm/s. In Unit 6 pumpset P1 is well within the limit, also the motor of pumpset P2. No data are available for pump P2.

2. The velocity transducer on pump P2, Unit 6, and its associated circuits and gain settings should be checked to determine the cause of an unusually low reading.

Approved:

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Manager
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Submitted:

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Technologist
Plant Equipment Dynamics Section

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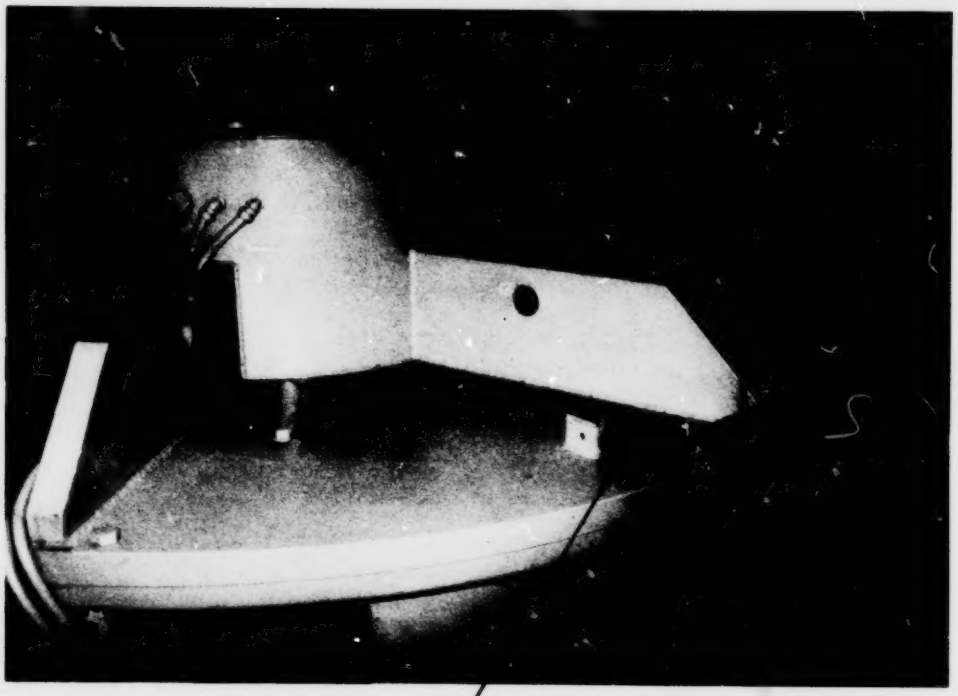
REFERENCES

1. F. Perricone "Pickering NGS 'B' Unit 5 - Condenser Cooling Water Pumpset Vibration Acceptance Tests" Research Division Report No 83-5-k, April 1983.

2. R.B. Jay, W.D. Morgan, "Pickering NGS 'B' Vibration Monitoring System" Research Division Report No 83-392-K, October 1983.

3. Pickering NGS 'B' Tendering Document for CCW Pumpsets - NK-30-TH-71210-01.



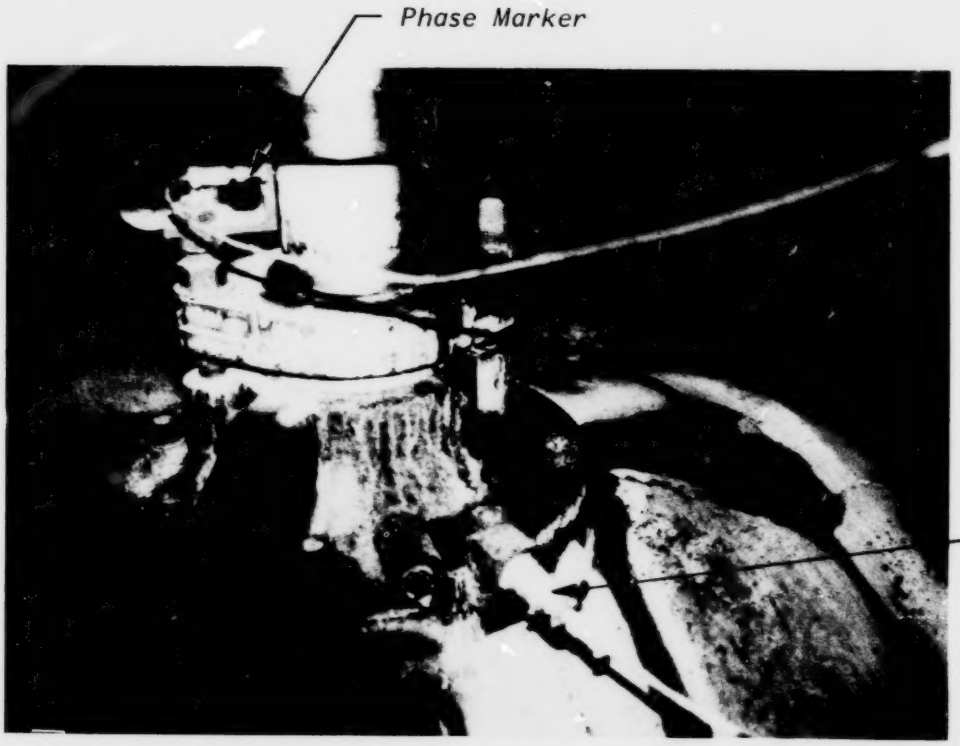


FIGURE 1

PICKERING NGS 'B' CCW PUMPSET
VIBRATION SENSOR INSTALLATIONS

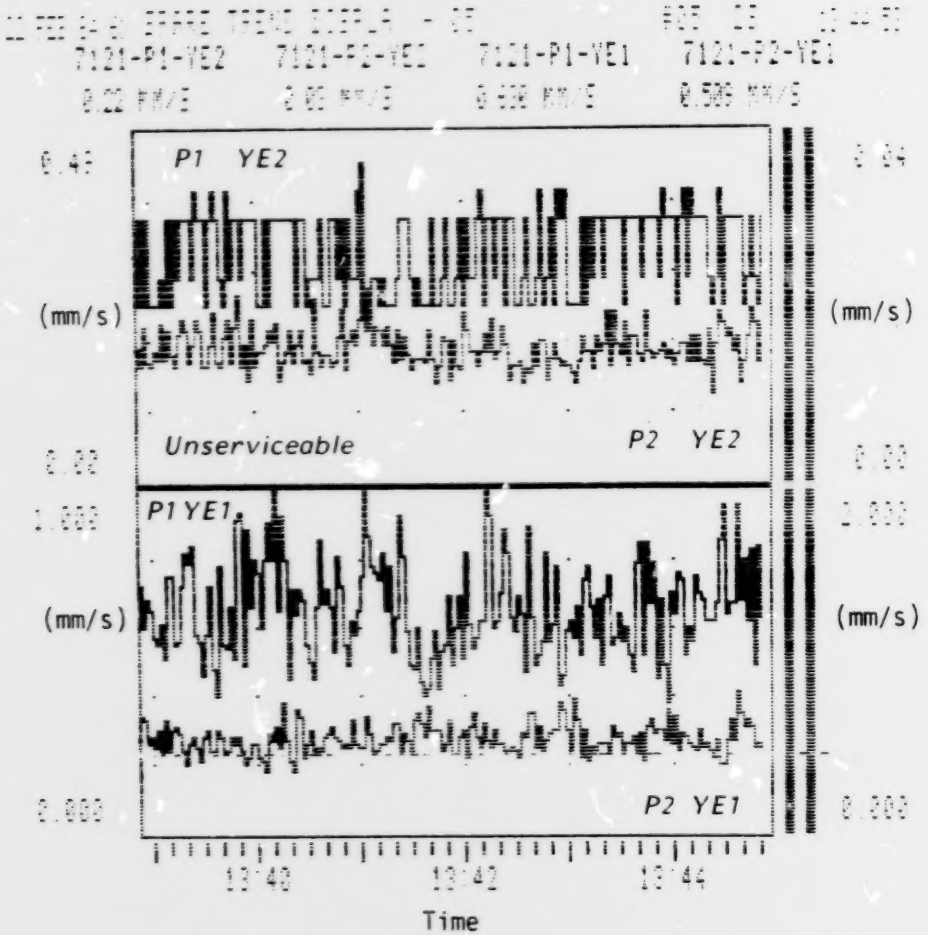
173044-RD

APPENDIX A

UNITS 6, 7 AND 8 - CCW PUMPSETS

VIBRATION VELOCITY AGAINST TIME AT FULL UNIT LOAD

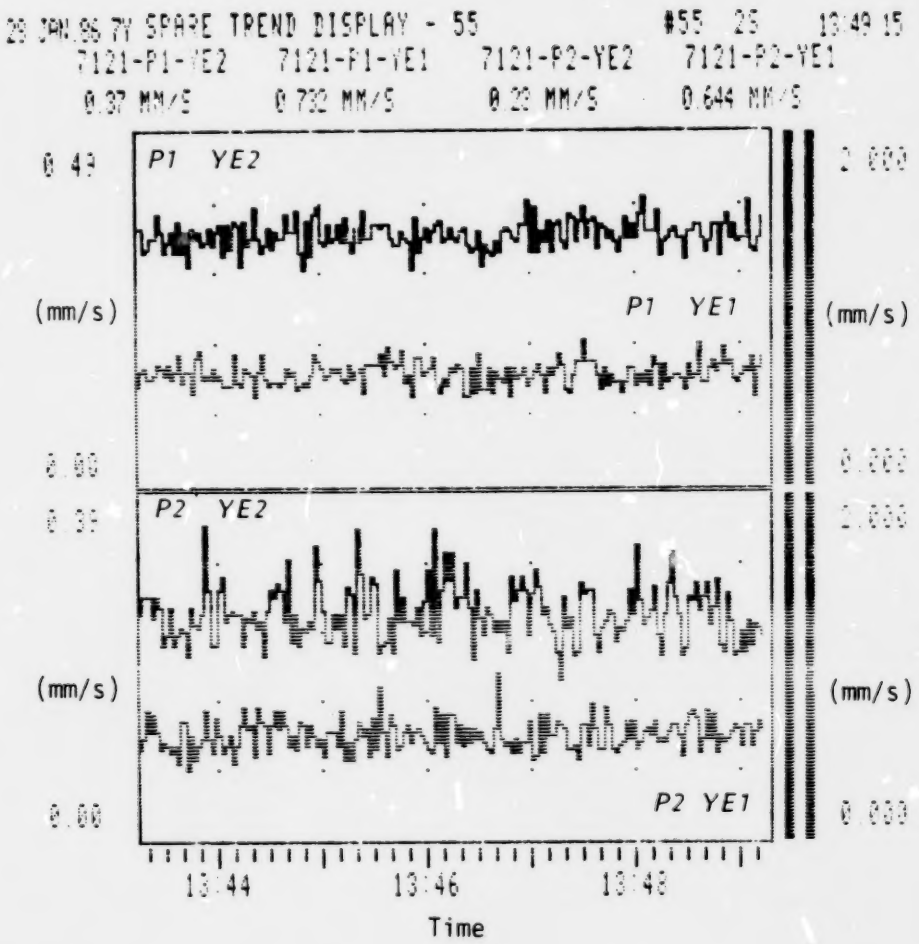
UNIT	PUMPSET	FIG	DESCRIPTION
6	1	A1	Top of Motor (YE1)
	2	A1	Pump (YE2)
7	1	A2	Top of Motor (YE1)
	2	A2	Pump (YE2)
8	1	A3	Top of Motor (YE1)
	2	A3	Pump (YE2)



YE1 = Top of Motor
YE2 = Pump

FIGURE A1

UNIT 6
CCW PUMPSETS P1 & P2
VIBRATION VELOCITY AGAINST TIME
AT FULL UNIT LOAD



YE1 = Top of Motor
YE2 = Pump

FIGURE A2

UNIT 7
CCW PUMPSETS P1 & P2
VIBRATION VELOCITY AGAINST TIME
AT FULL UNIT LOAD

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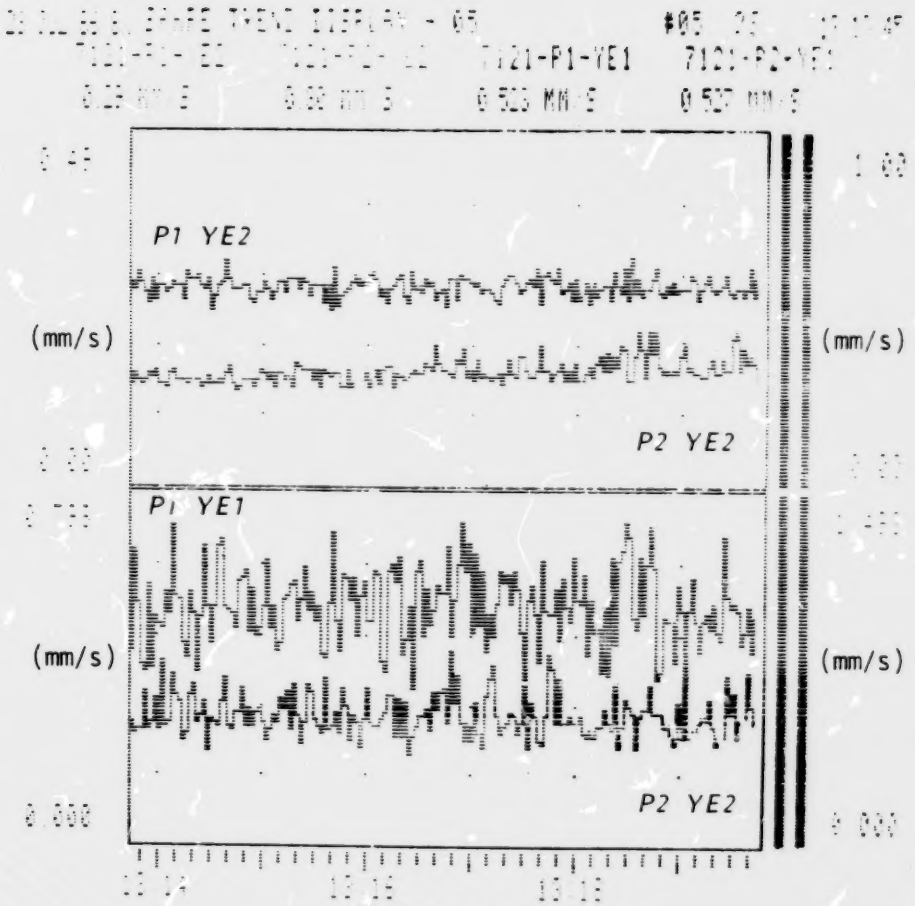

YE1 = Top of Motor
YE2 = Pump

FIGURE A3

UNIT 8
CCW PUMPSETS P1 & P2
VIBRATION VELOCITY AGAINST TIME
AT FULL UNIT LOAD

86-333

APPENDIX B

UNIT 6 - CCW PUMPSETS

VIBRATION VELOCITY SPECTRA AT FULL UNIT LOAD

PUMPSET NO.	FIG	DESCRIPTION	FREQUENCY RANGE (HZ)
1	B1	Top of Motor (YE1)	.3-100
	B2	Top of Motor (YE1)	1-500
	B3	Pump (YE2)	.3-100
	B4	Pump (YE2)	1-500
2	B5	Top of Motor (YE1)	.3-100
	B6	Top of Motor (YE2)	1-500
	NO DATA AVAILABLE FOR PUMP		

PICKERING NGS"B" UNIT#6
CCW PUMP#1 YE-1 (MOTOR)
REACTOR POWER 99 % 22/02/84

PEAK NO.	FREQUENCY	AMPLITUDE
1	26.5	.0116
2	23	.1866
3	18	.1517
4	19	.1464
5	22	.1381
6	28	.00716
7	28.75	.00457
8	30	.00068
9	20	.00474
10	21	.0775
11	60	.07253
12	13.25	.00207
13	31.5	.03005
14	15	.02835
15	8.75	.02824
16	52.75	.02374
17	7.75	.02104
18	65	.01901
19	61.25	.01756
20	66.5	.01456

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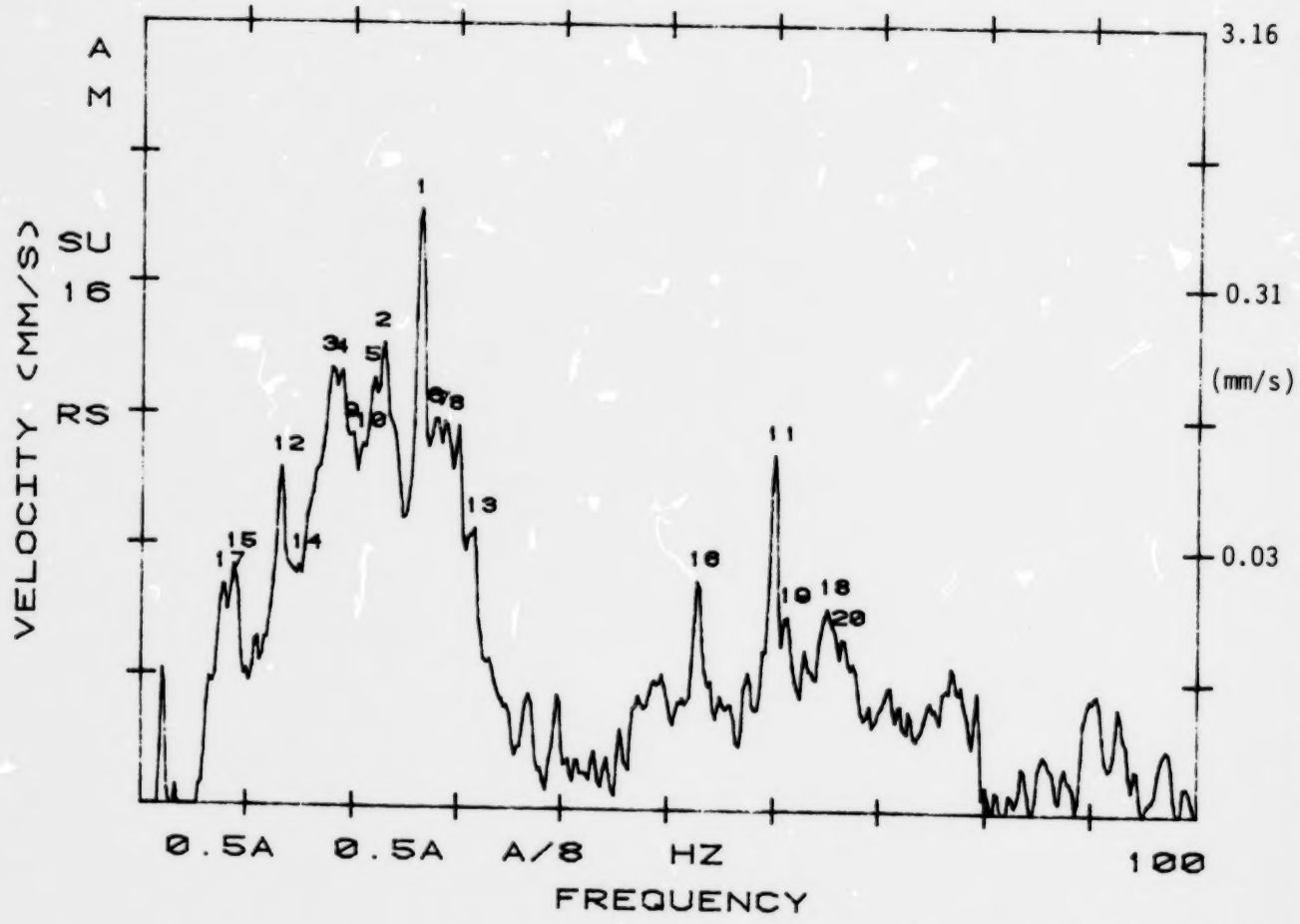

FIGURE B1

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PICKERING NGS"B" UNIT#6
CCW PUMP#1 YE-1 (MOTOR)
REACTOR POWER 99 % 22/02/84

PEAK NO.	FREQUENCY	AMPLITUDE
1	26.25	.7403
2	22.5	.2937
3	18.75	.2348
4	13.75	.07658
5	80	.07645
6	8.75	.03736
7	360	.0352
8	52.5	.03375
9	65	.02972
10	120	.0253
11	90	.02197
12	77.5	.0211
13	48.75	.02012
14	72.5	.01645
15	298.75	.01478
16	30.25	.01389
17	41.25	.01234
18	1.25	.01215
19	98.25	.01147
20	107.5	.01147

3.16+00 E VLG

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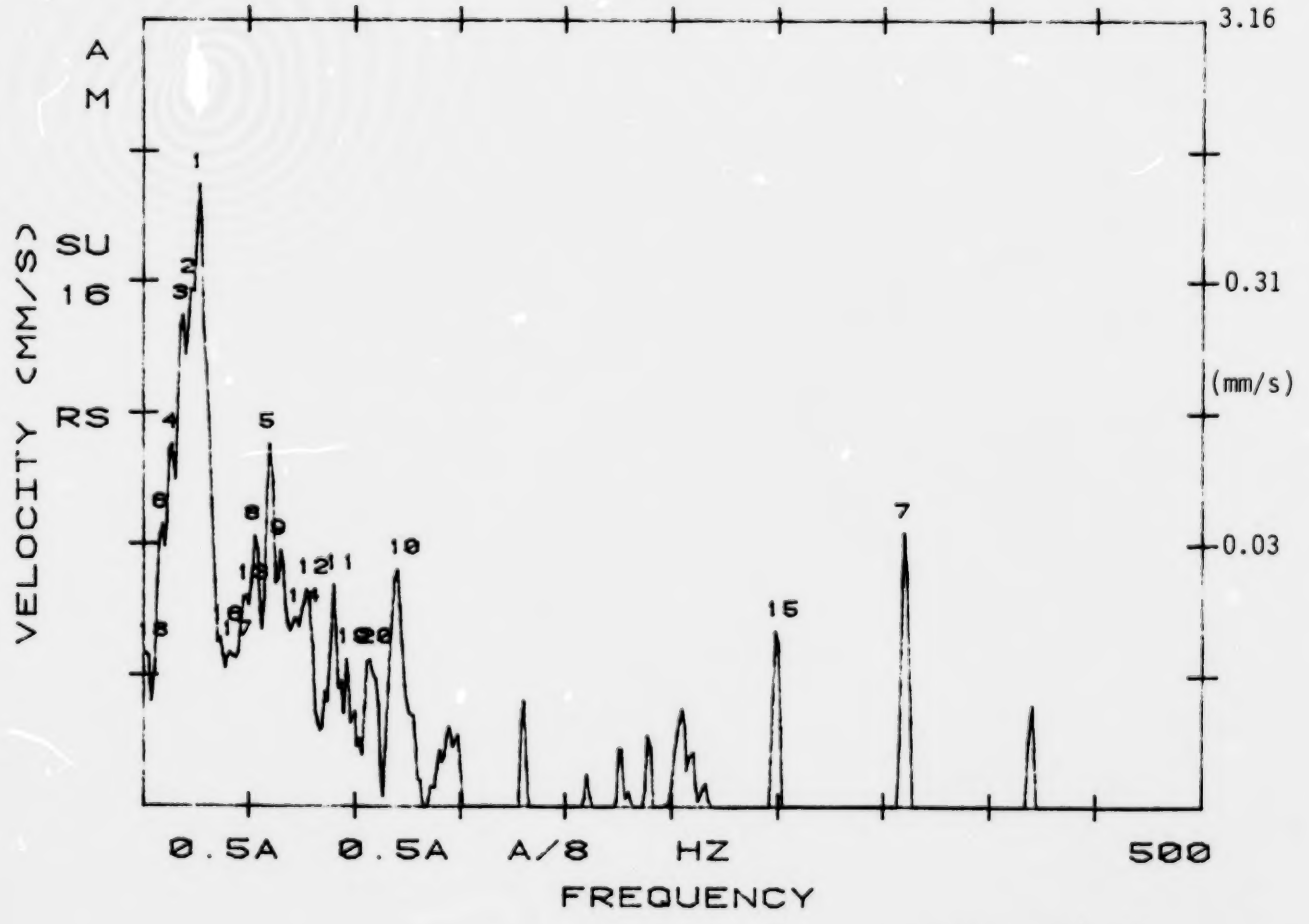

FIGURE B2

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PICKERING NGS"B" UNIT#6
CCW PUMP#1 YE-2 (PUMP)
REACTOR POWER 99%

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.02459 X 10
2	60	.02317
3	26.5	.01202
4	8.75	.01030
5	8	6.472E-03
6	31.5	5.676E-03
7	13.25	5.072E-03
8	30.75	4.173E-03
9	23	4.046E-03
10	11	3.954E-03
11	18.75	3.855E-03
12	24	3.801E-03
13	33.5	3.065E-03
14	12	3.012E-03
15	22	2.943E-03
16	28.5	2.908E-03
17	2	2.819E-03
18	10.25	2.760E-03
19	19.75	2.465E-03
20	16.5	2.409E-03

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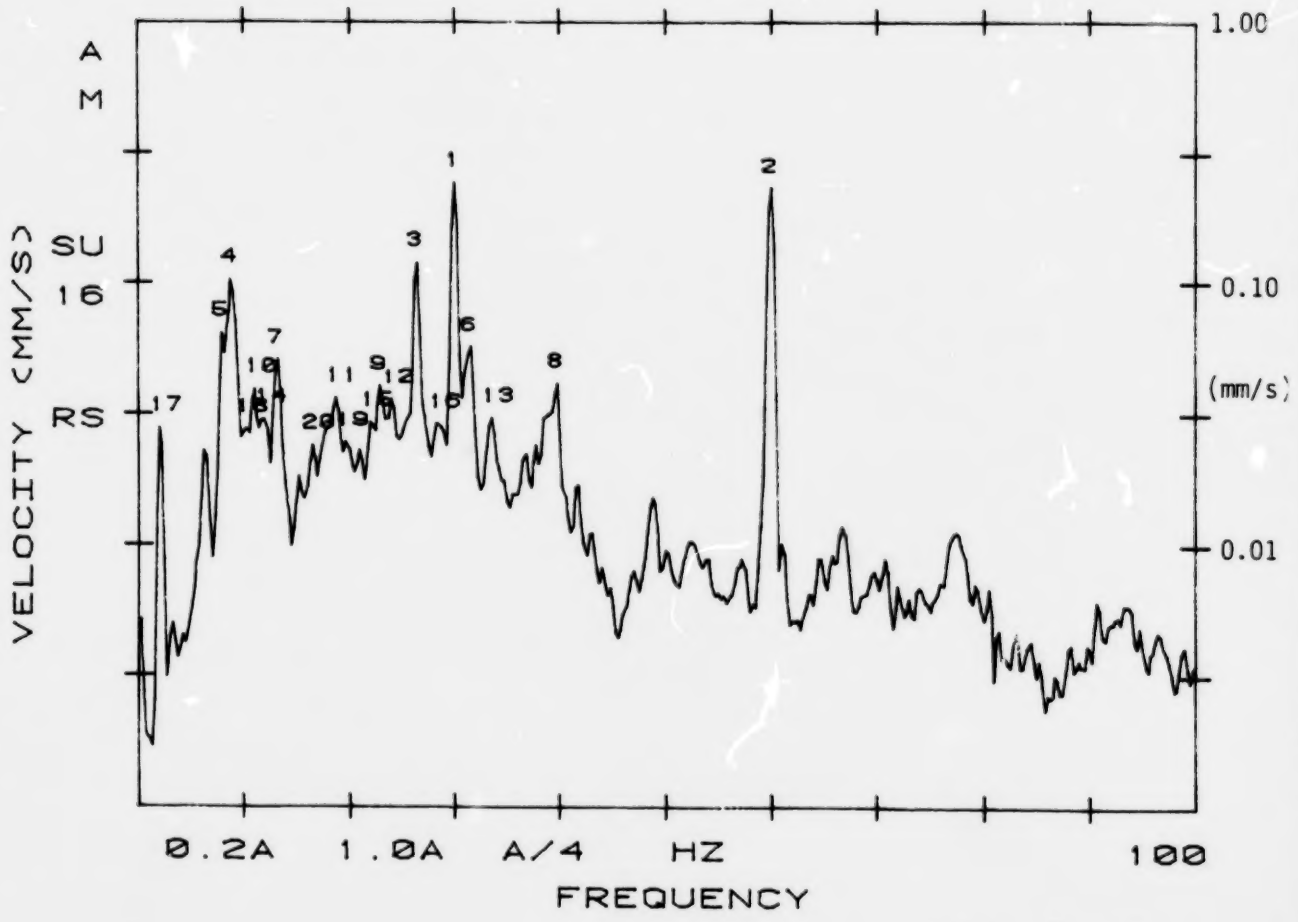

FIGURE B3

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PICKERING NGS"B" UNIT#6
CCW PUMP#1 YE-2 (PUMP)
REACTOR POWER 99%

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.02492 X 10
2	60	.02307
3	8.75	.01694
4	120	.01601
5	26.25	.01216
6	300	8.191E-03
7	18.75	7.961E-03
8	38.75	7.759E-03
9	298.75	5.383E-03
10	1.25	3.18E-03
11	50	2.674E-03
12	90	2.567E-03
13	180	2.505E-03
14	77.5	2.194E-03
15	66.25	2.124E-03
16	238.75	2.001E-03
17	72.5	1.808E-03
18	103.75	1.729E-03
19	96.25	1.585E-03
20	418.75	1.573E-03

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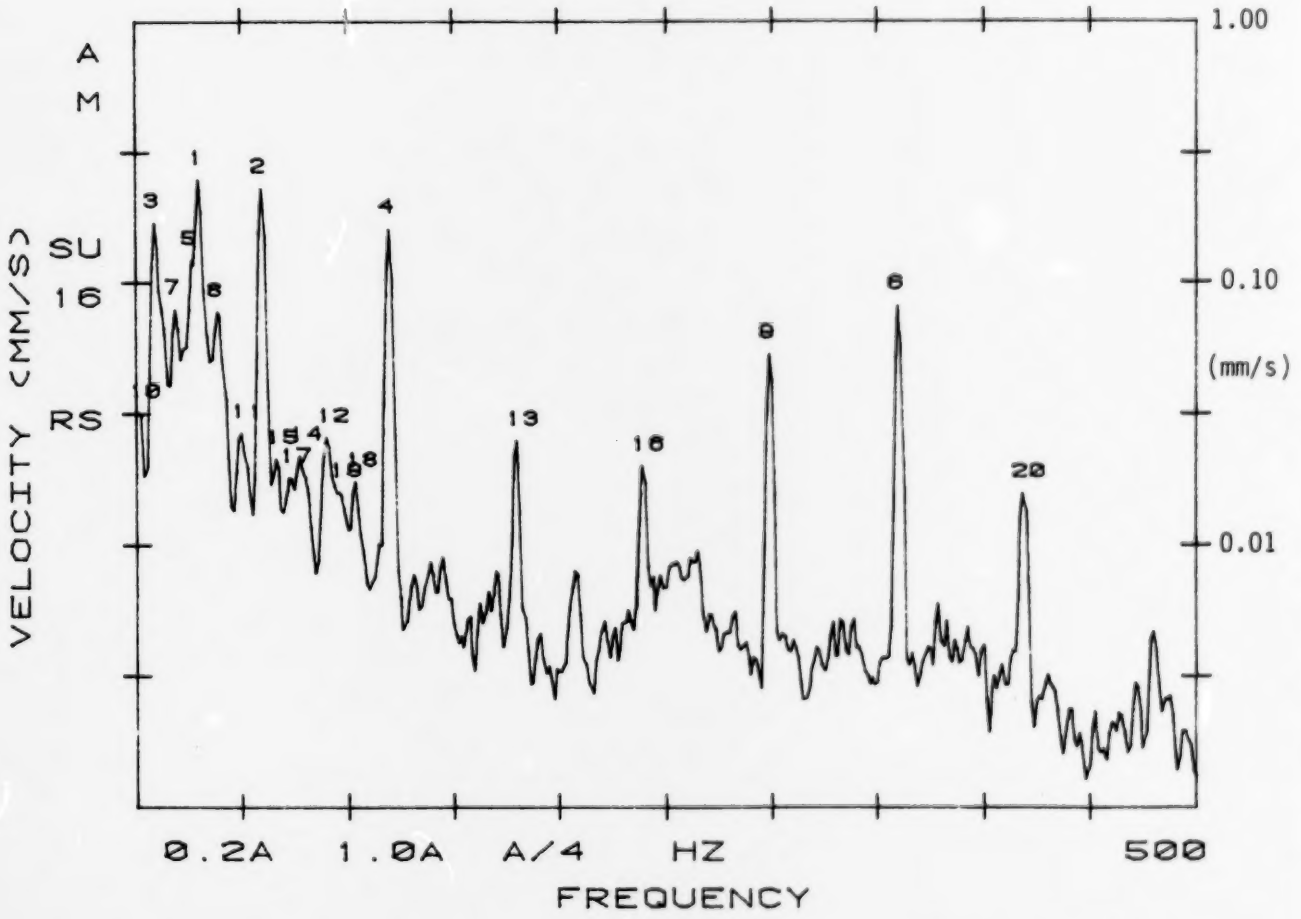

FIGURE B4
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PICKERING NGS"B" UNIT#6
CCW PUMP#2 YE-1 (MOTOR)
REACTOR POWER 99%

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.3787
2	26.5	.3652
3	25.25	.1641
4	24.25	.1523
5	20	.1182
6	19.25	.09862
7	27.25	.09769
8	20.75	.0888
9	21.75	.08446
10	60	.08283
11	22.5	.05985
12	31.75	.048
13	13.25	.04431
14	17.75	.04307
15	52.75	.028
16	16.5	.02785
17	8	.02733
18	8.75	.02258
19	62	.02079
20	61	.01794

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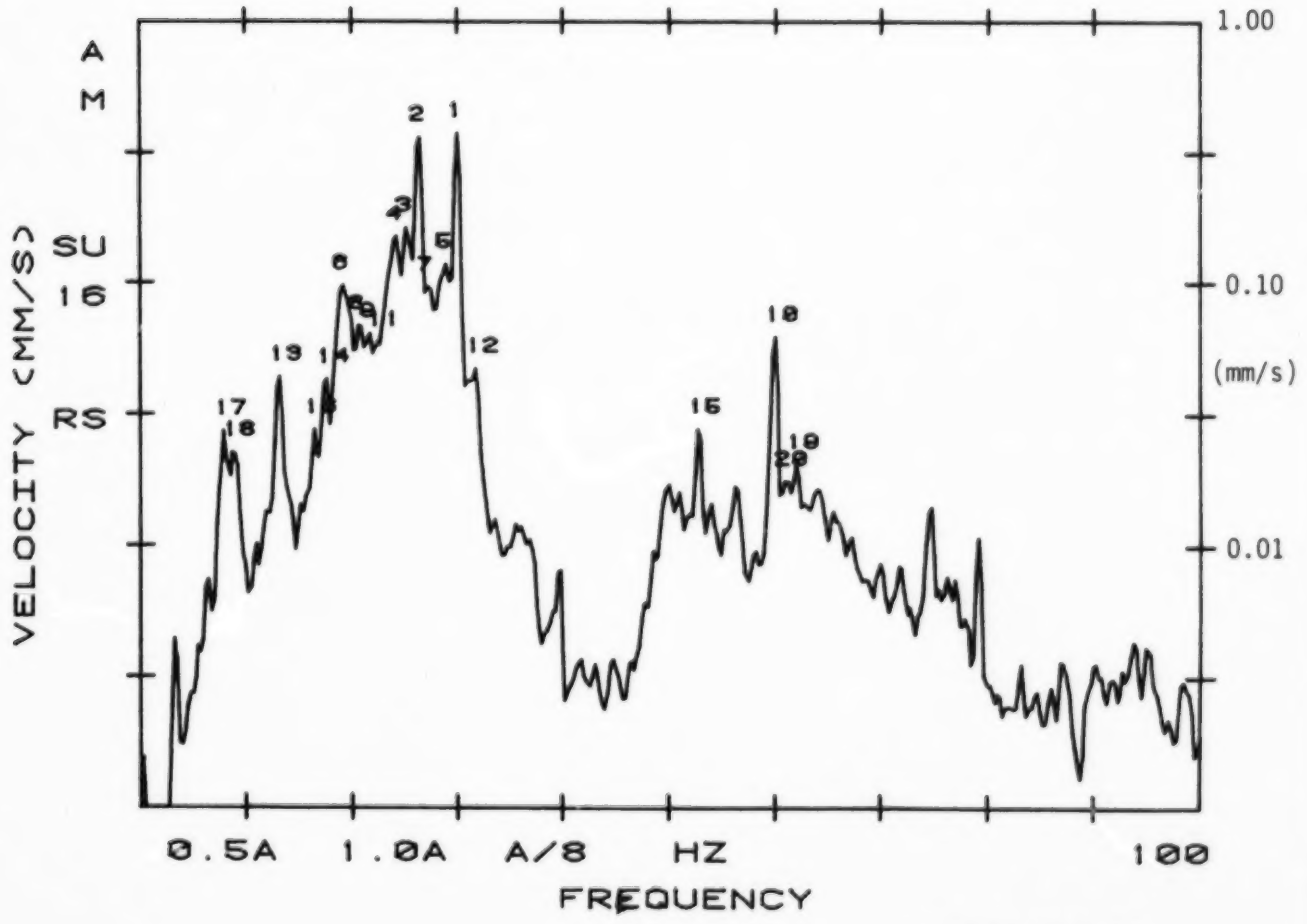

FIGURE B5

86-333

PICKERING NGS"B" UNIT#6
CCW PUMP#2 YE-1 (MOTOR)
REACTOR POWER 99%

PEAK NO.	FREQUENCY	AMPLITUDE
1	26.25	.4952
2	30	.3981
3	20	.1958
4	60	.07243
5	120	.05053
6	8.75	.04905
7	12.5	.04516
8	52.5	.0413
9	50	.04124
10	300	.0338
11	75	.02423
12	78.75	.01816
13	70	.01729
14	208.75	.01492
15	41.25	.0125
16	201.25	.01097
17	180	9.115E-03
18	87.5	8.930E-03
19	93.75	8.324E-03
20	91.25	7.242E-03

83.6-03 V/EA 1.00+00 E VLG

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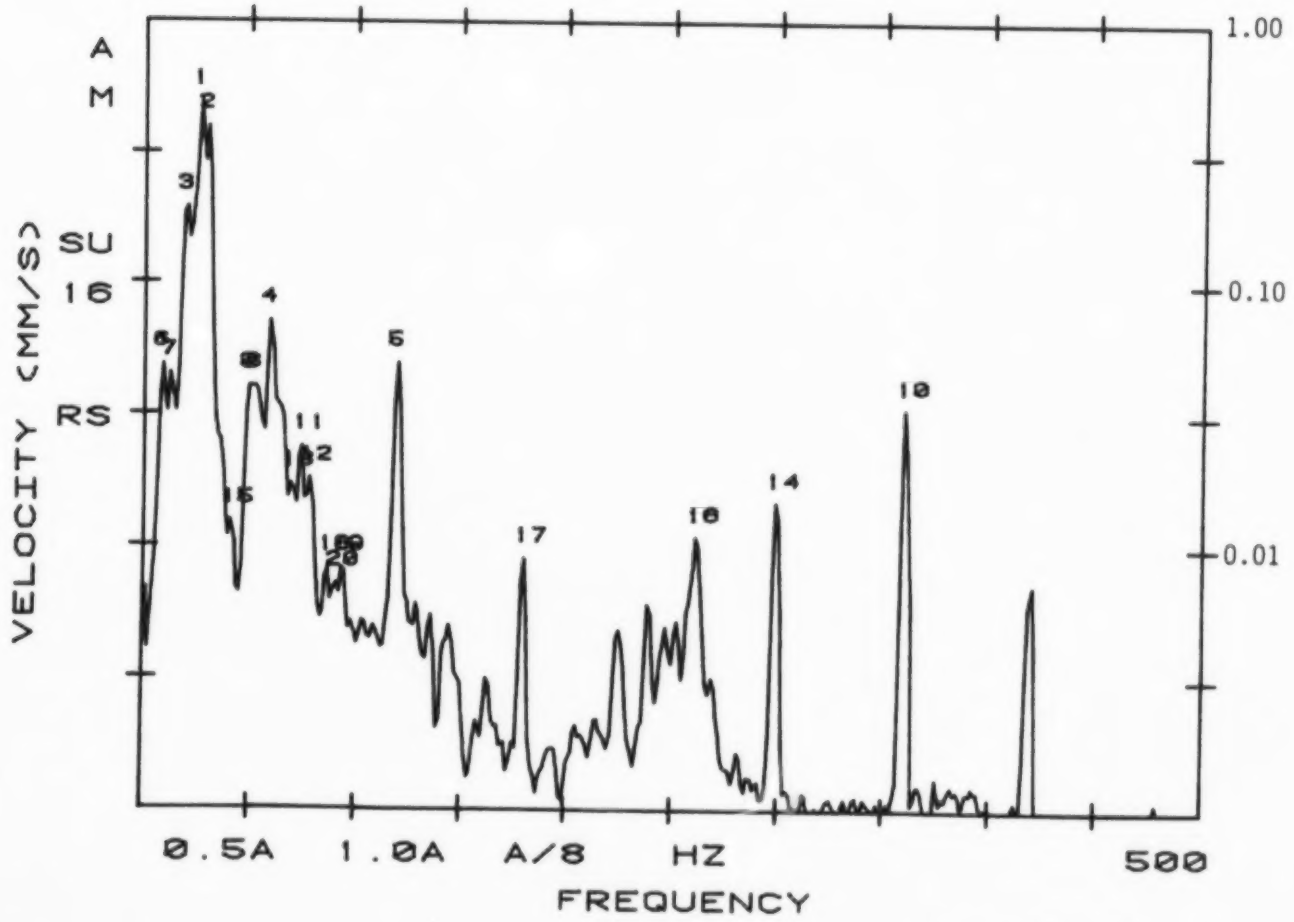

FIGURE B6
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APPENDIX C

UNIT 7 - CCW PUMPSETS

VIBRATION VELOCITY SPECTRA AT FULL UNIT LOAD

PUMPSET NO.	FIG	DESCRIPTION	FREQUENCY RANGE (HZ)
1	C1	Top of Motor (YE1)	.3-100
	C2	Top of Motor (YE1)	.5-200
	C3	Pump (YE2)	.3-100
	C4	Pump (YE2)	.5-200
2	C5	Top of Motor (YE1)	.3-100
	C6	Top of Motor (YE1)	.5-200
	C7	Pump (YE2)	.3-100
	C8	Pump (YE2)	.5-200

PICKERING NGSB UNIT#7
CCW PUMP#1 YE-1
REACTOR POWER 99% 29/01/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.4488
2	26.5	.3159
3	19.75	.2094
4	22	.1063
5	22.75	.00835
6	24.5	.08038
7	13.25	.07834
8	16.5	.04342
9	31.75	.03818
10	52.75	.02367
11	15.75	.01881
12	74.75	.01605
13	78.75	.01594
14	50	.01541
15	14.75	.01537
16	66.25	.01496
17	60	.01383
18	53.75	.01341
19	33	.01314
20	68	.01173

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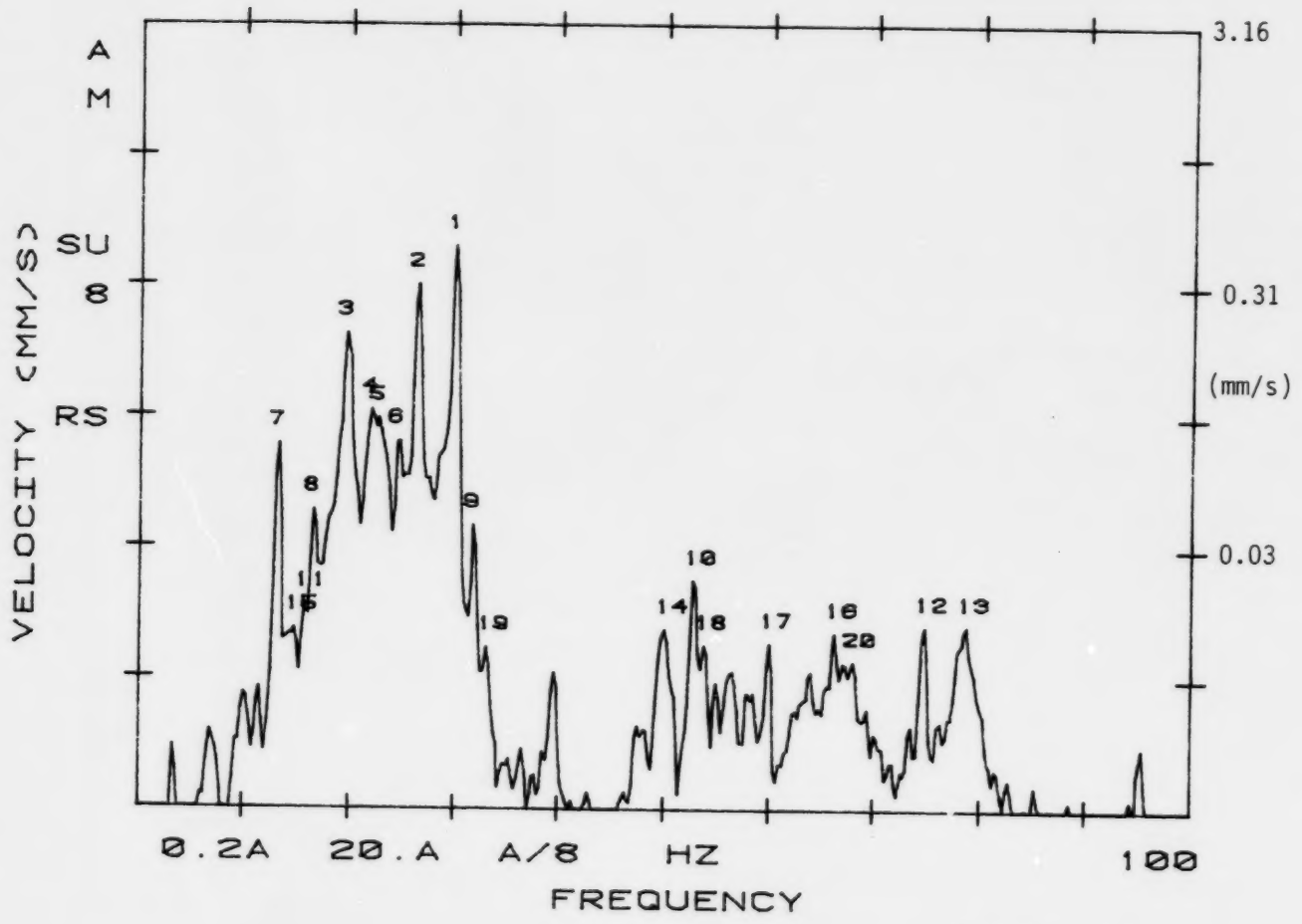

FIGURE C1

PICKERING NGSB UNIT#7
CCW PUMP#1 YE-1
REACTOR POWER 99% 29/01/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.4462
2	26.5	.3233
3	19.5	.1861
4	22.5	.1451
5	13	.08777
6	16.5	.04627
7	53	.02766
8	79.5	.02397
9	65	.02107
10	67.5	.0149
11	74.5	.01372
12	83	.01361
13	10	.01346
14	39.5	.01294
15	60	.01284
16	49.5	.01059
17	120	9.352E-03
18	36.5	8.507E-03
19	57	7.593E-03
20	6.5	6.991E-03

83.6-03 V/EA 3.16+00 L VLG

C

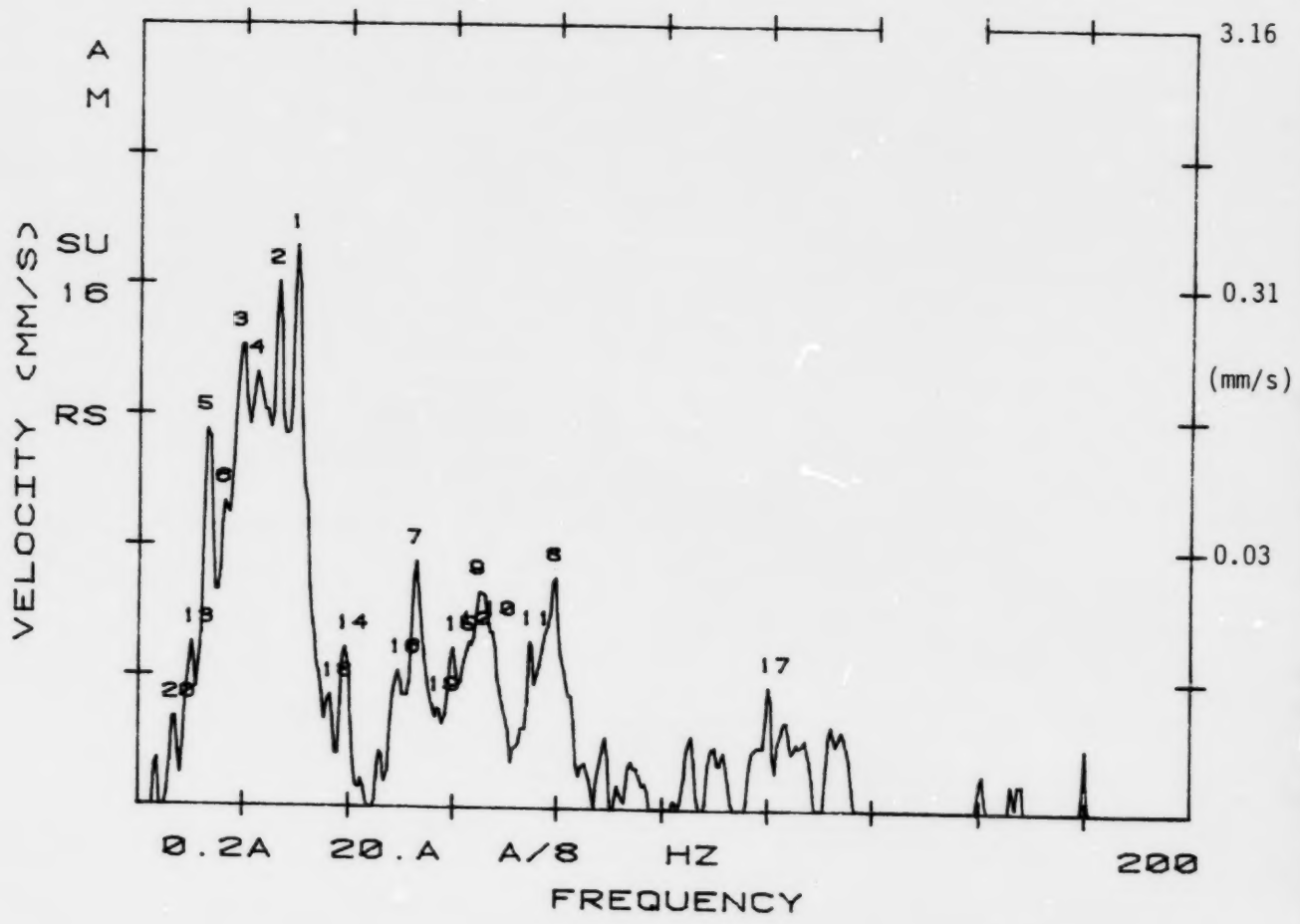

FIGURE C2

PICKERING NGSB UNIT#7
CCW PUMP#1 YE-2
REACTOR POWER 99% 29/01/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.2274
2	31.5	.05833
3	13.25	.05191
4	74.75	.04859
5	26.5	.04559
6	40.25	.03741
7	41.25	.03658
8	43	.03505
9	42.25	.03428
10	2	.03066
11	.25	.02972
12	10.75	.02575
13	36.25	.0204
14	23.25	.01993
15	33	.01717
16	20.5	.01649
17	21.75	.01533
18	28.25	.01498
19	16.5	.0147
20	44.5	.01103

24.9-03 V/EA 1.00+00 E VLG

C

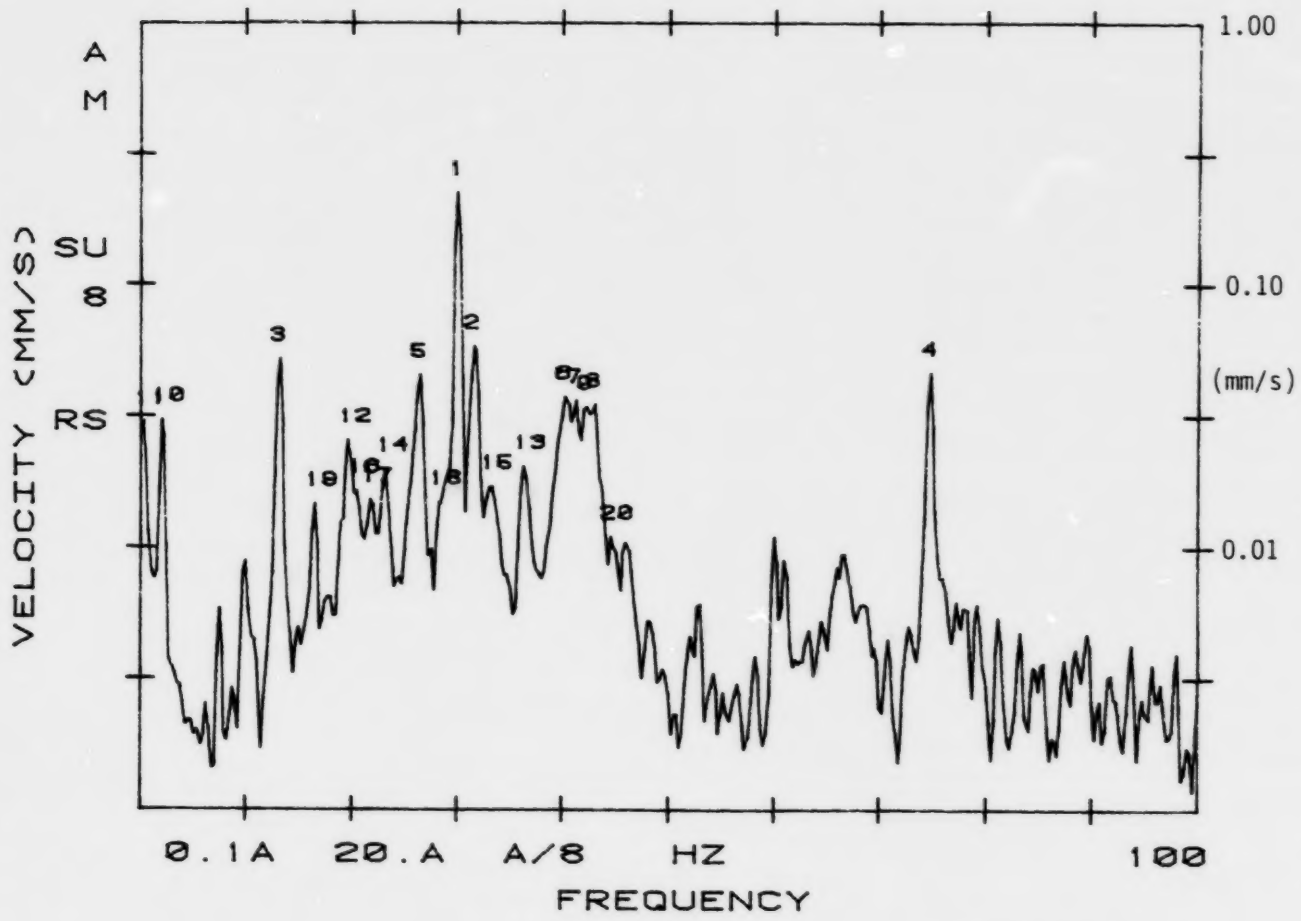

FIGURE C3

86-333

PICKERING NGSB UNIT#7
CCW PUMP#1 YE-2
REACTOR POWER 99% 29/01/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.2283
2	26.5	.06116
3	40.5	.05739
4	31.5	.05616
5	74.5	.0506
6	13	.04999
7	43	.04266
8	120	.03621
9	2	.03254
10	20	.0277
11	36.5	.02533
12	23	.02429
13	22	.01823
14	16.5	.01791
15	180	.01722
16	66.5	.01372
17	60	.01078
18	77.5	.01040
19	10	.01032
20	61	9.017E-03

24.9-03 V/EA 1.00+00 E VLG

C

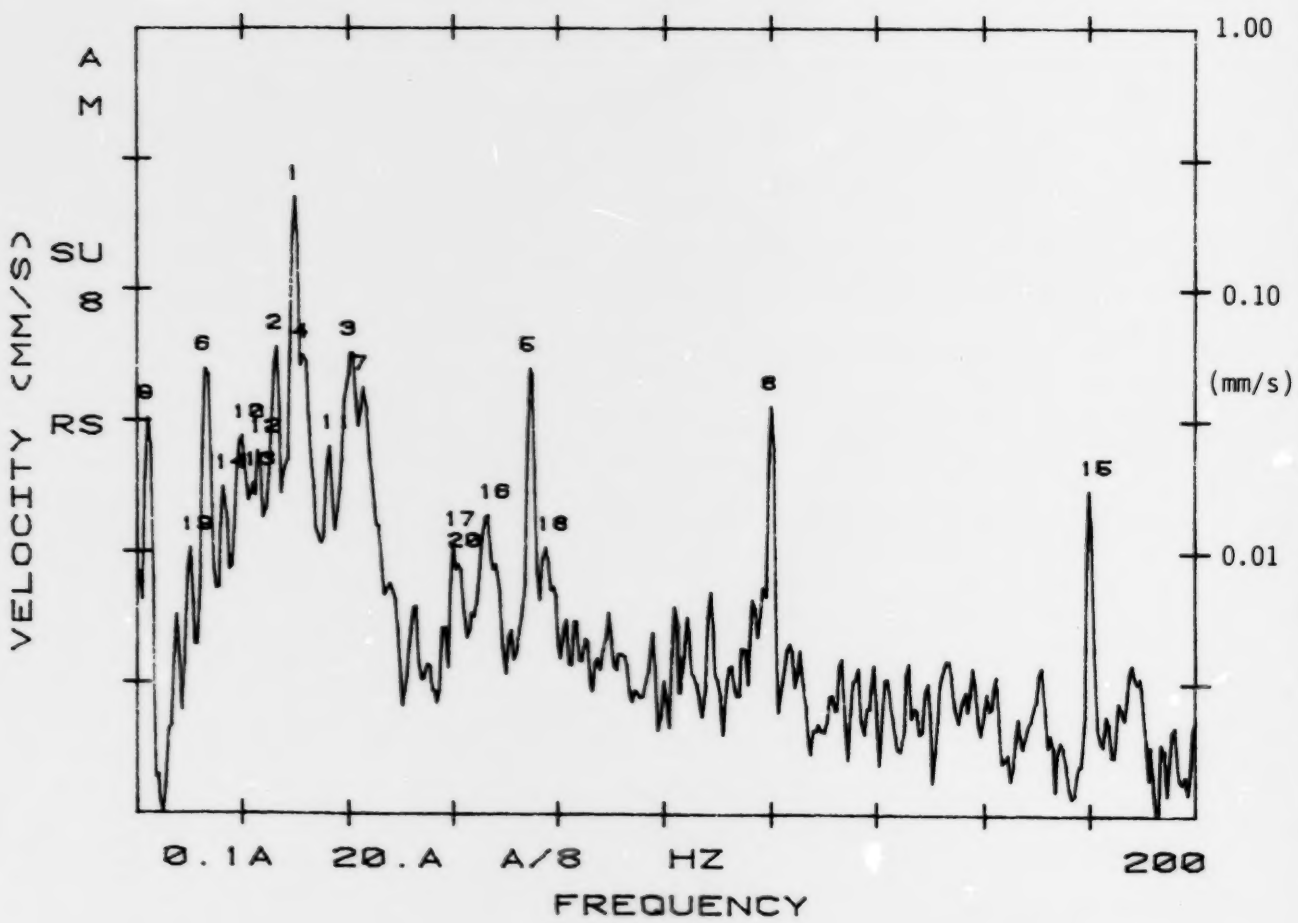

FIGURE C4
86-333

PICKERING NGSB UNIT#7
CCW PUMP#2 YE-1
REACTOR POWER 99% 29/01/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.2719
2	28.25	.1746
3	24.5	.1732
4	25.5	.1573
5	28.25	.1419
6	23.5	.1416
7	20	.14
8	29	.1383
9	19.5	.1146
10	21.5	.08808
11	18.75	.05305
12	13.25	.05255
13	17.75	.05019
14	74.75	.04767
15	64.75	.0388
16	63	.03124
17	32	.0281
18	66	.02413
19	52.75	.02974
20	57.5	.02246

83.6-03 V/EA 1.00+00 E VLG

C

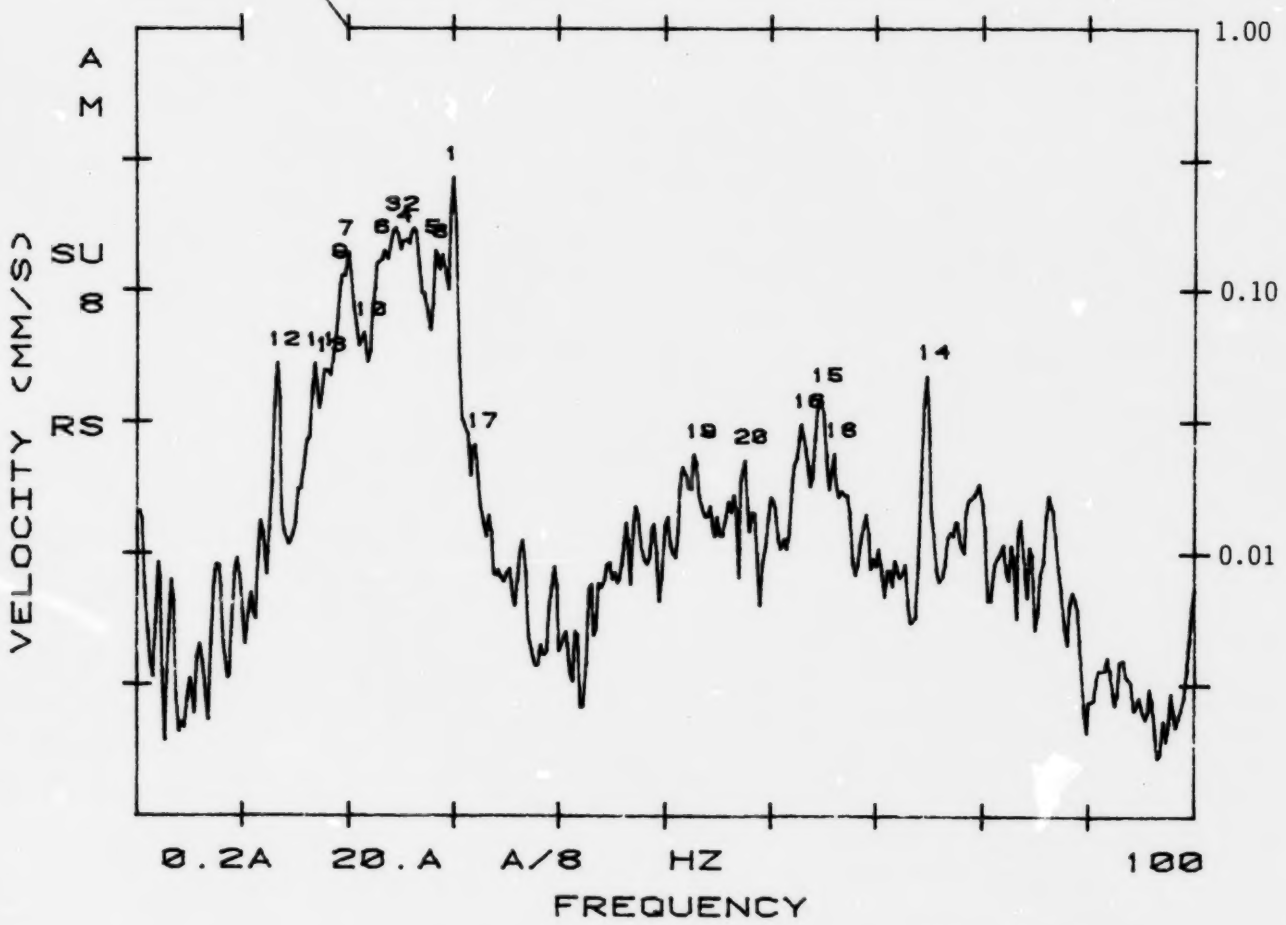

FIGURE C5

86-333

PICKERING NGSB UNIT#7
CCW PUMP#2 YE-1
REACTOR POWER 99% 29/01/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.2219
2	20	.1941
3	28.5	.177
4	29.5	.1374
5	13.5	.05213
6	74.5	.0413
7	15.5	.02708
8	70.5	.02582
9	53	.02472
10	120	.02218
11	33	.02142
12	68	.01789
13	36.5	.01552
14	60	.01541
15	78	.01429
16	88	.01391
17	9.5	.01274
18	57.5	.01208
19	82	.01155
20	39.5	.01075

83.6-03 V/EA 1.00+00 E VLG

C

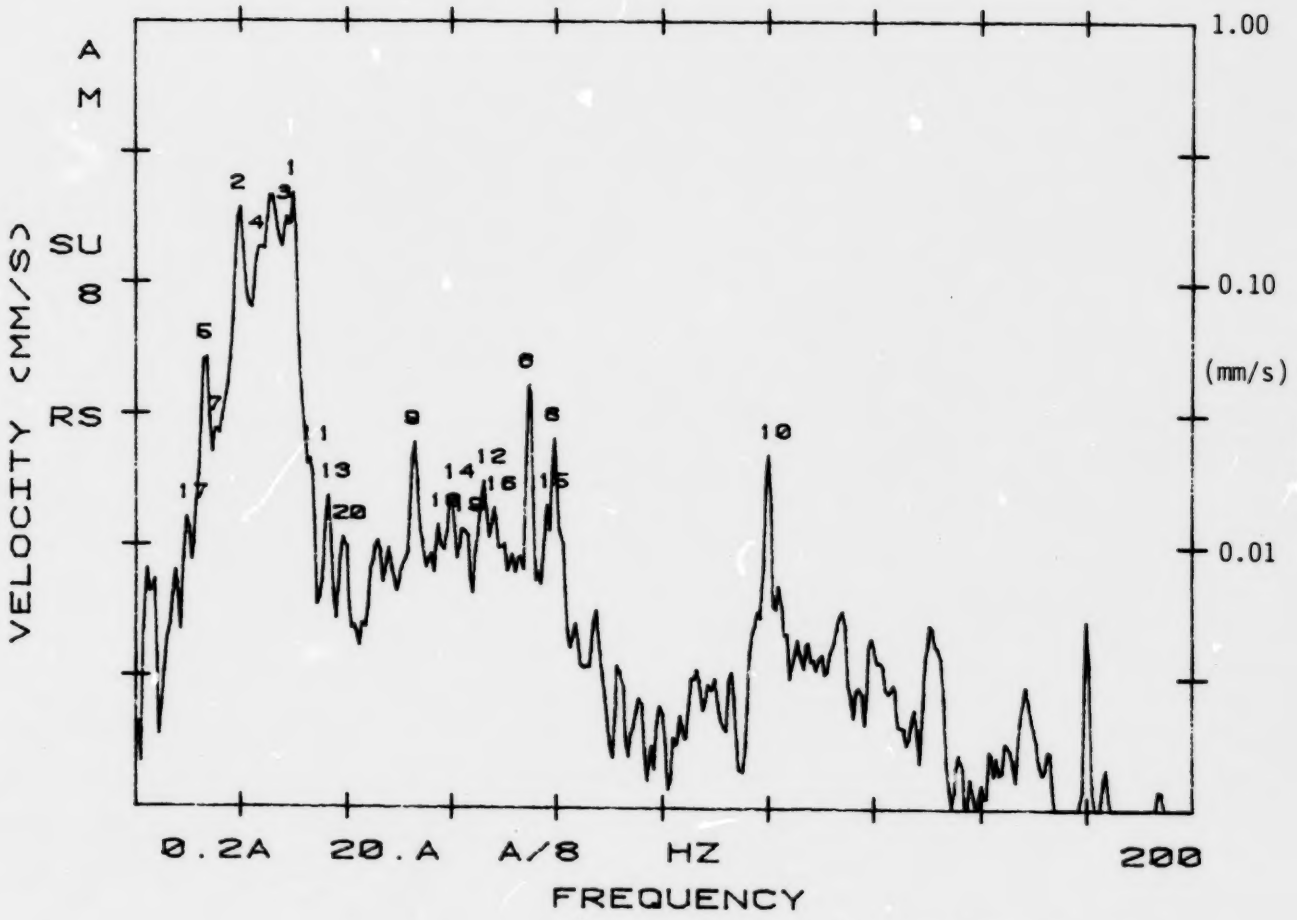

FIGURE C6
86-333

PICKERING NGSB UNIT#7
CCW PUMP#2 YE-2
REACTOR POWER 99% 29/01/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.172
2	74.75	.1159
3	32	.04048
4	28.5	.03249
5	2	.03124
6	10.75	.02955
7	44.75	.02267
8	76	.02243
9	13.25	.02107
10	42.75	.02042
11	43.5	.01991
12	40.5	.01753
13	39.5	.0175
14	35	.01681
15	48	.01685
16	42	.01527
17	23	.0145
18	25.25	.01359
19	24.25	.01348
20	22.25	.01319

24.9-03 V/EA 1.00+00 E VLG

C

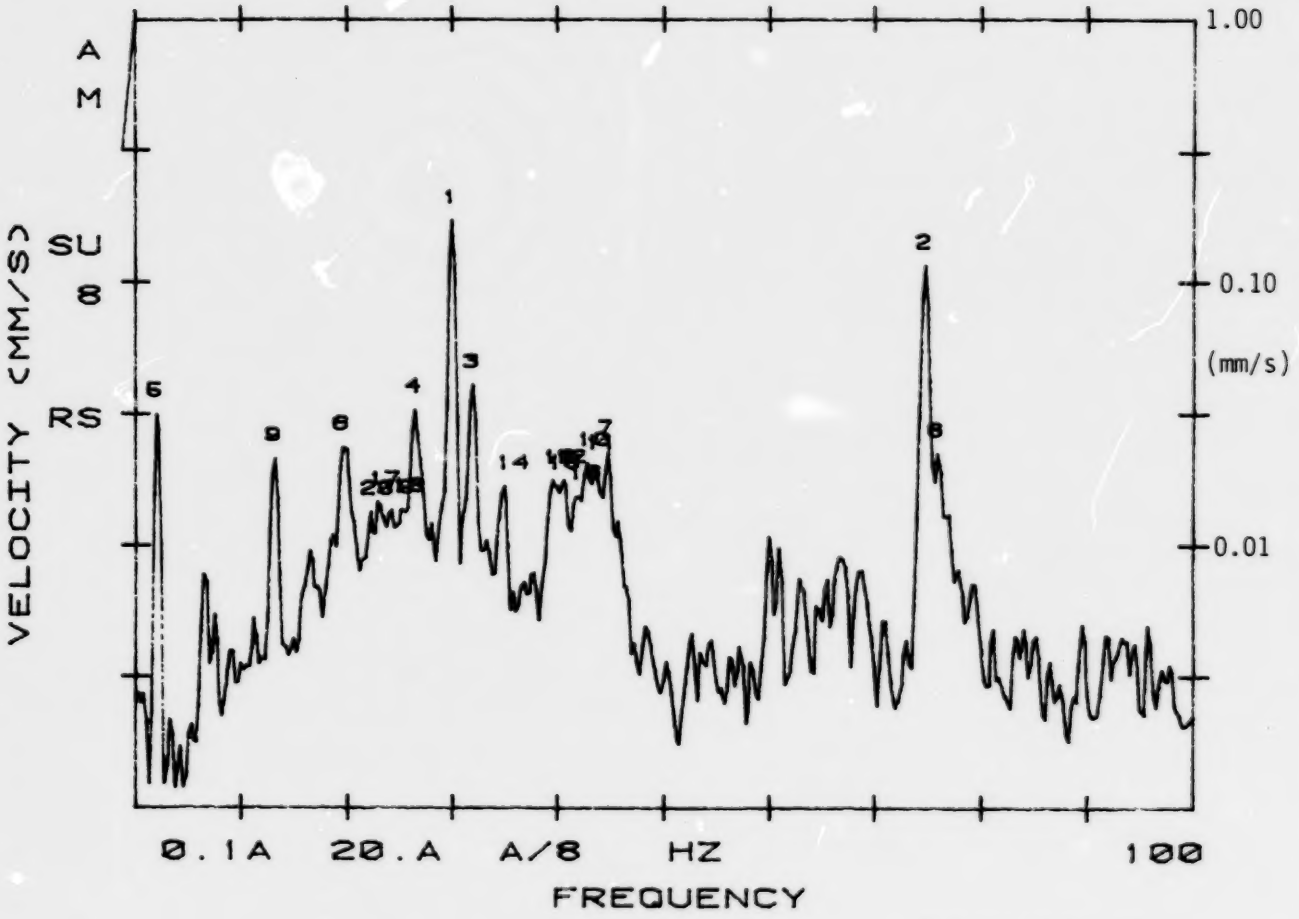

FIGURE C7

PICKERING NGSB UNIT#7
CCW PUMP#2 YE-2
REACTOR POWER 99% 29/01/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.1756
2	75	.09092
3	26.5	.03792
4	32	.03731
5	2	.0321
6	42.5	.03021
7	44.5	.0262
8	40	.02482
9	13	.02139
10	120	.02127
11	35	.02026
12	22.5	.01932
13	180	.01806
14	110	.01767
15	60	.01672
16	19	.01531
17	112	.01394
18	67	.01346
19	16.5	.01108
20	113.5	.01075

24.9-03 V/EA 1.00+00 E VLG

C

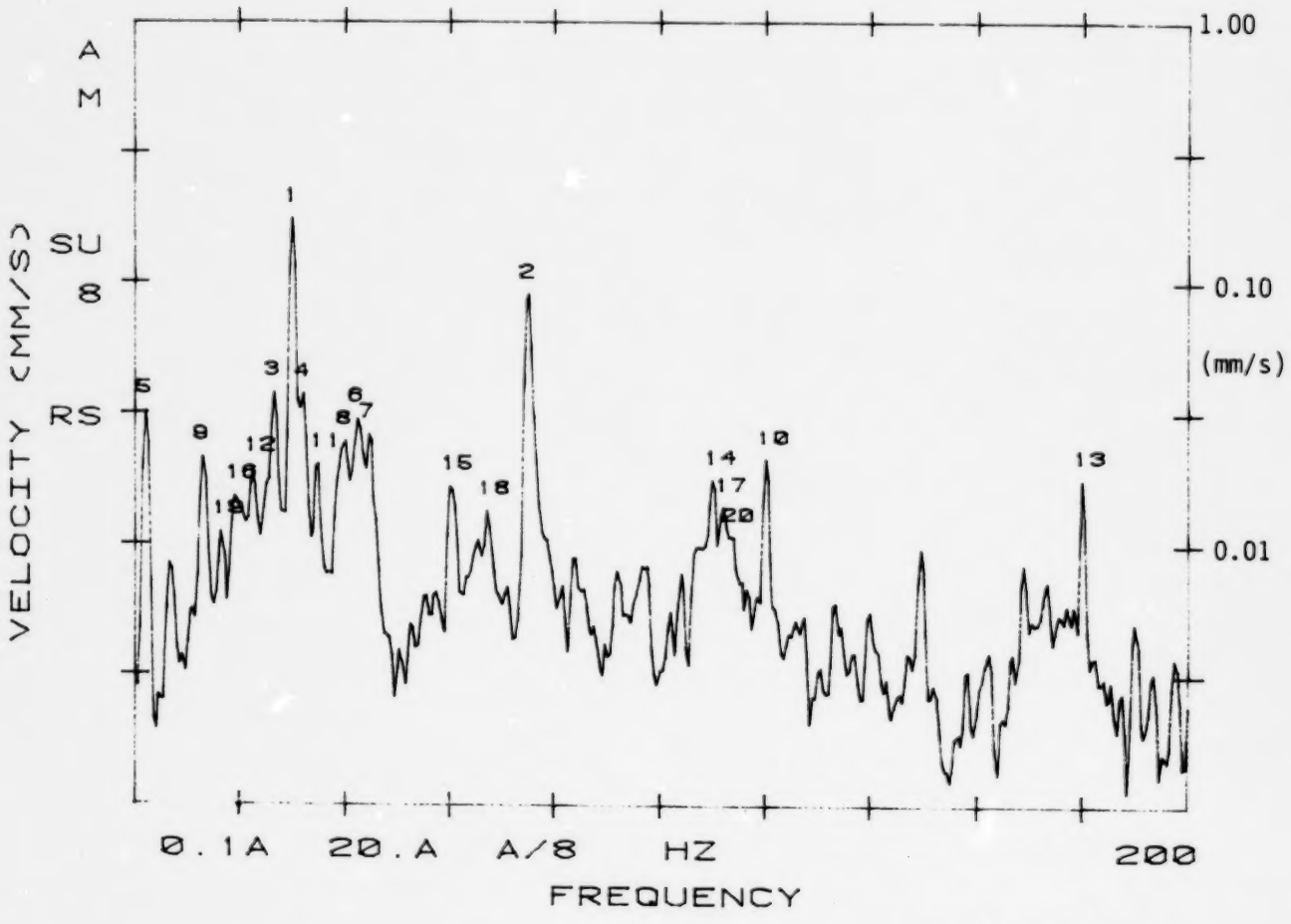

FIGURE C8

86-333

APPENDIX D

UNIT 8 - CCW PUMPSET

VIBRATION VELOCITY SPECTRA AT FULL UNIT LOAD

PUMPSET NO.	FIG	DESCRIPTION	FREQUENCY RANGE (HZ)
1	D1	Top of Motor (YE1)	.3 - 100
	D2	Top of Motor (YE1)	.5 - 200
	D3	Pump (YE2)	.3 - 100
	D4	Pump (YE2)	.5 - 200
2	D5	Top of Motor (YE1)	.3 - 100
	D6	Top of Motor (YE1)	.5 - 200
	D7	Pump (YE2)	.3 - 100
	D8	Pump (YE2)	.5 - 200

PICKERING NGS"B" UNIT#8
CCW PUMP#1 YE-1 (MOTOR)
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	28.5	.3083
2	30	.1954
3	28.75	.1311
4	23	.1295
5	19.5	.1265
6	22	.08862
7	25.25	.07898
8	13.25	.0657
9	24.25	.05046
10	16.5	.03726
11	52.75	.02674
12	79.25	.02056
13	14.75	.01956
14	31.5	.01896
15	32.75	.01865
16	92.5	.01527
17	80.25	.01488
18	81.25	.01308
19	88	.01241
20	74.75	.01215

83.6-03 V/EA 1.00+00 E VLG

C

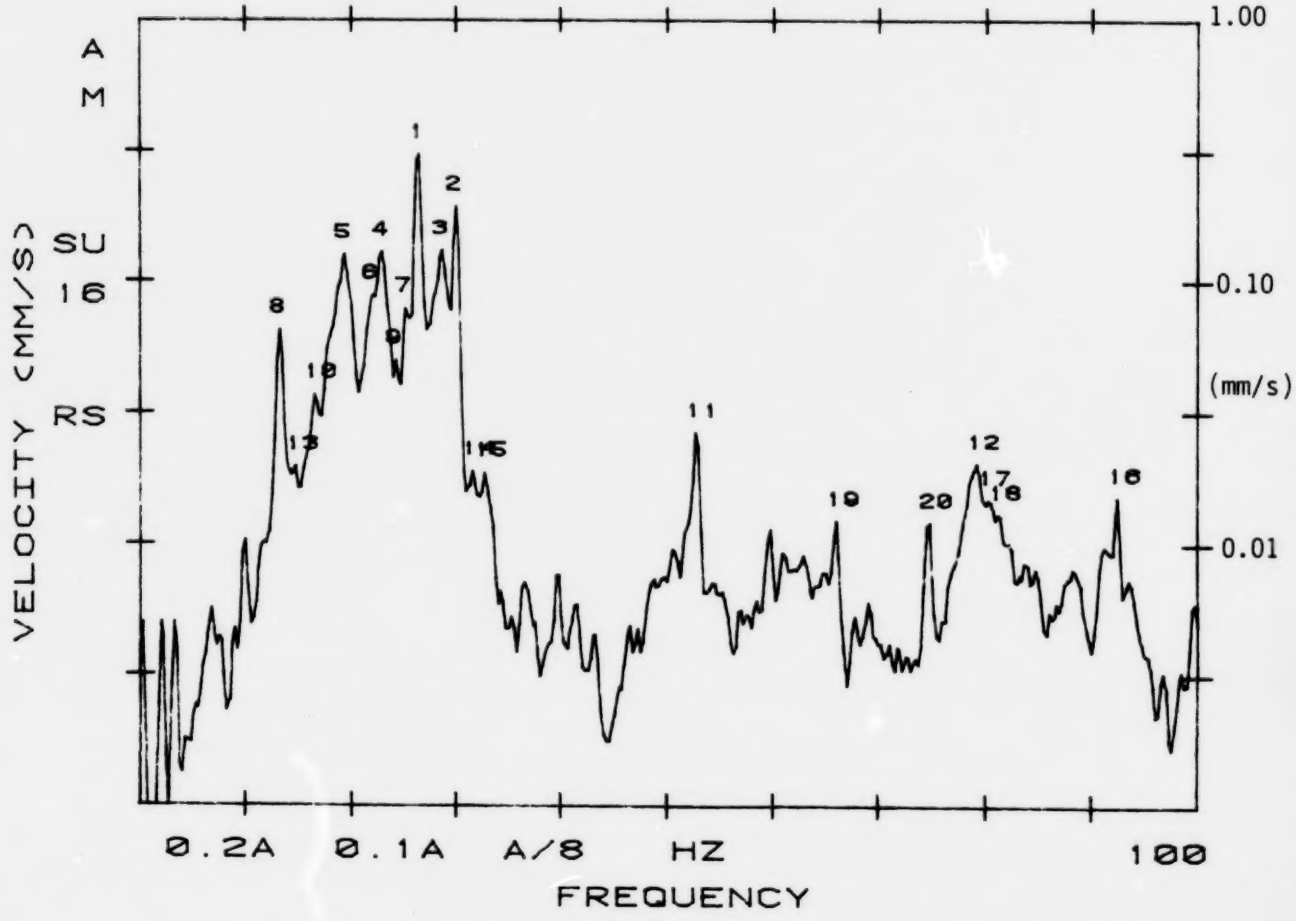

FIGURE D1
86-333

PICKERING NGS"B" UNIT#8
CCW PUMP#1 YE-1 (MOTOR)
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	26.5	.2513
2	30	.1956
3	19	.1734
4	23	.1523
5	28.5	.1253
6	13	.08315
7	53	.04516
8	16.5	.03501
9	79	.03087
10	120	.02557
11	33	.02452
12	66	.02317
13	92.5	.02203
14	82	.02023
15	74.5	.01858
16	60	.01699
17	118	.01665
18	85	.01494
19	62	.01482
20	50	.01415

83.6-03 V/EA 1.00+00 E VLG

C

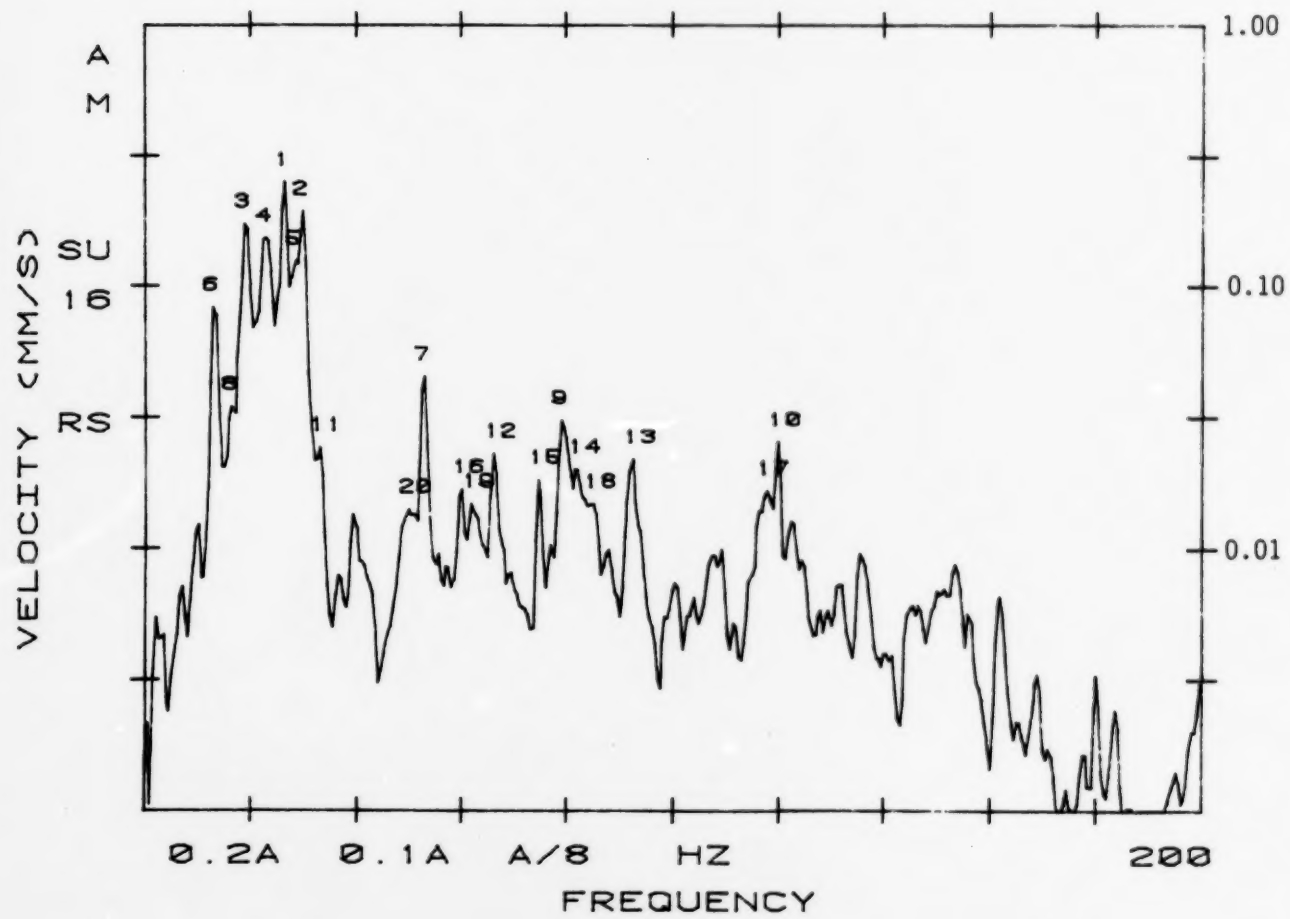

FIGURE D2
86-333

PICKERING NGS"B" UNIT#8
CCW PUMP#1 YE-2 (PUMP)
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.1456
2	13.25	.03426
3	26.5	.02984
4	32.75	.02789
5	74.75	.0252
6	33.25	.02231
7	92.5	.02006
8	19.25	.01985
9	28.25	.01985
10	42	.01692
11	36.5	.01537
12	39.5	.01523
13	2	.01464
14	31.25	.0133
15	25	.01312
16	23	.01303
17	43.25	.01202
18	60	.01166
19	52.75	.01162
20	66	.01157

25.2-03 V/EA 1.00+00 E VLG

C

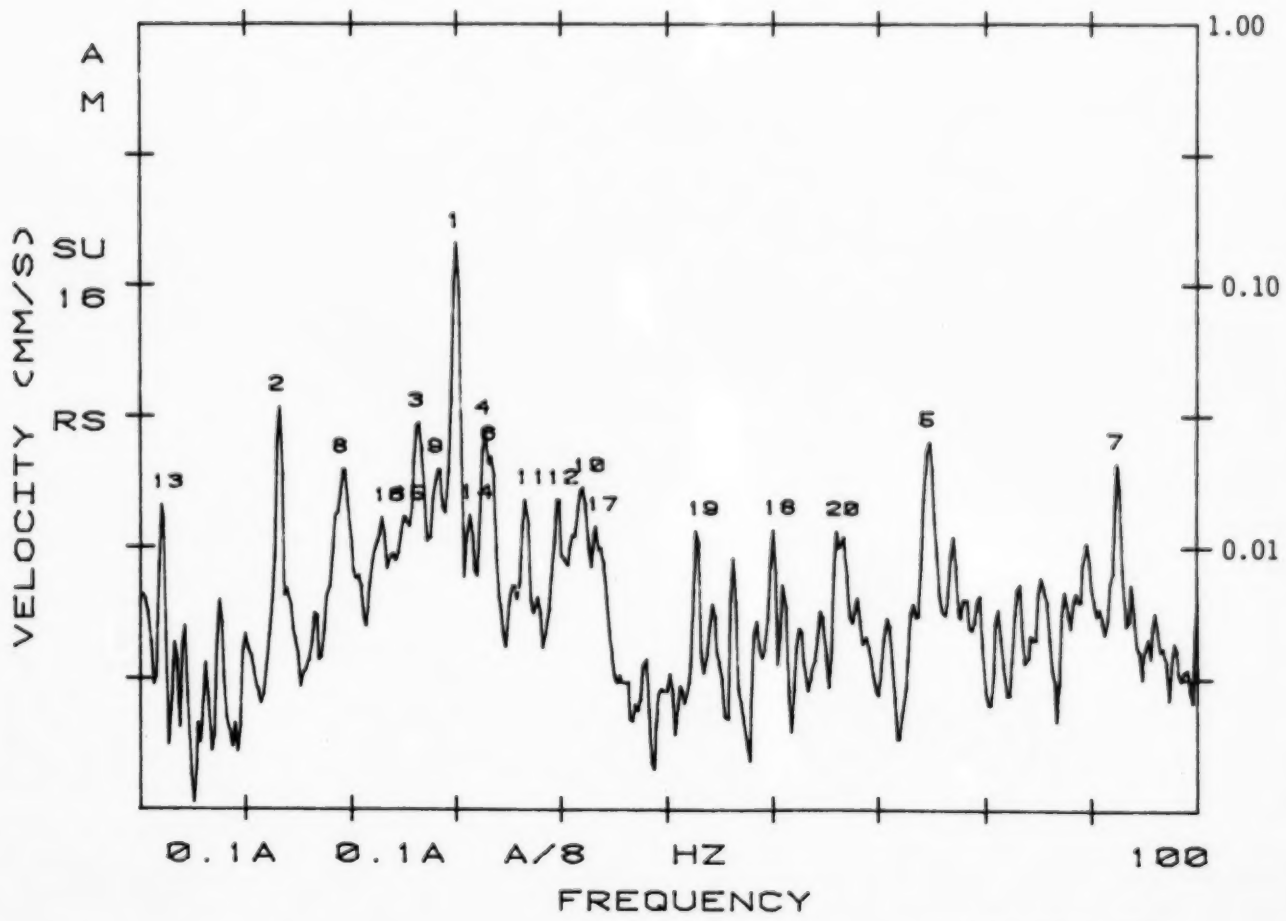

FIGURE D3

PICKERING NGS"B" UNIT#8
CCW PUMP#1 YE-2 (PUMP)
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	120	.1458
2	30	.1397
3	26.5	.05407
4	13	.03621
5	74.5	.02582
6	39.5	.02476
7	19.5	.02345
8	33	.02107
9	42	.01977
10	36.5	.01784
11	23	.01692
12	92.5	.0166
13	60	.01541
14	2	.01308
15	177.5	.01272
16	179.5	.0127
17	142	.01248
18	181.5	.01236
19	53	.01206
20	122	.01152

25.2-03 V/EA 1.00+00 E VLG

C

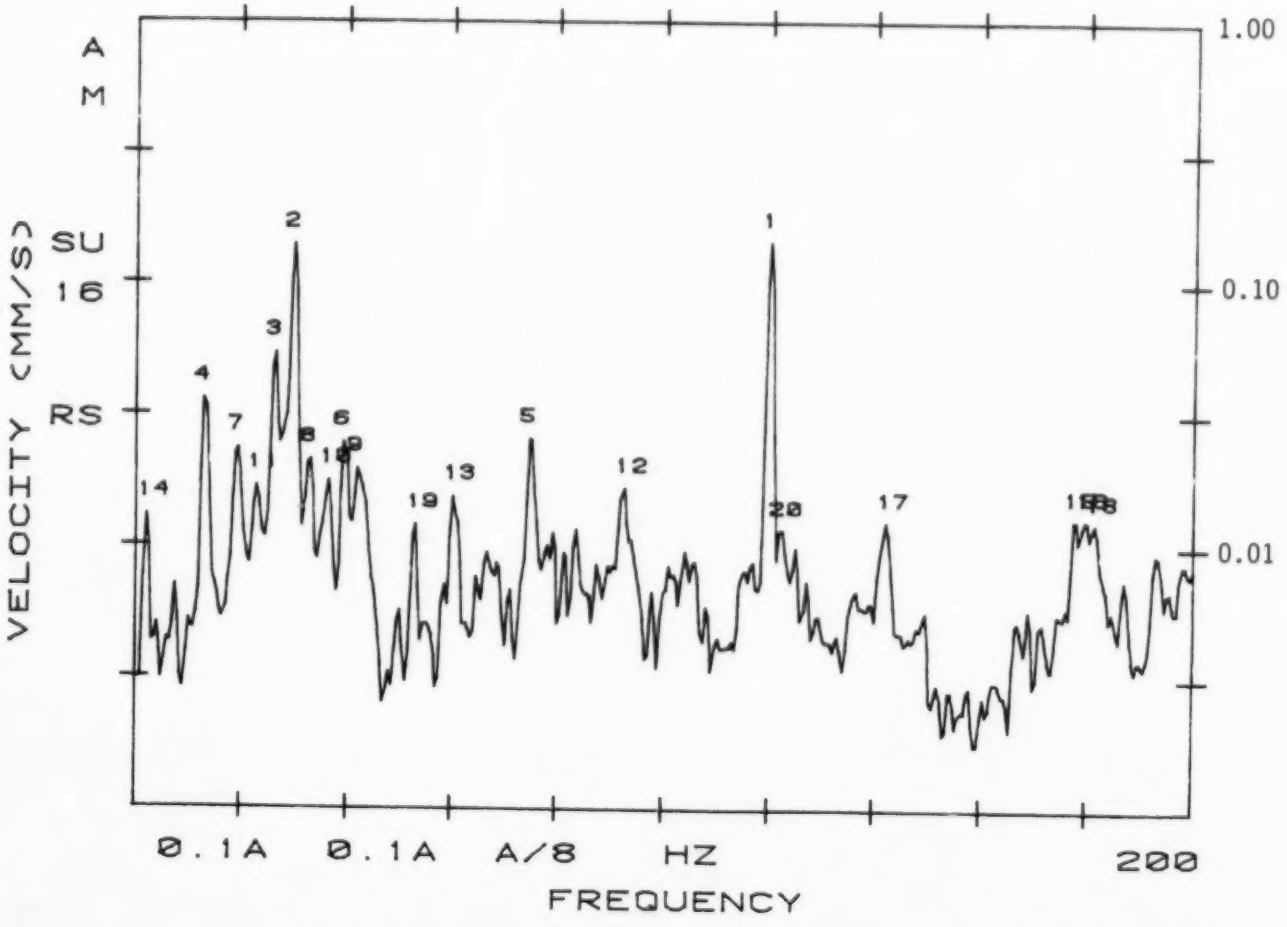

FIGURE D4
86-333

PICKERING NGS "B" UNIT#8
CCW PUMP#2 YE-1 (MOTOR)
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	19.75	.2346
2	28.5	.2137
3	20.75	.1451
4	22.5	.1245
5	22	.122
6	21.25	.00220
7	28	.0827
8	13.25	.00368
9	16.75	.0527
10	31	.04058
11	24.75	.04871
12	74.75	.03108
13	32.25	.02462
14	70.25	.02162
15	56.5	.01022
16	12.25	.01706
17	80.5	.01699
18	81.25	.01651
19	15	.0164
20	59.25	.01634

83.6-03 V/EA 1.00+00 E VLG

C

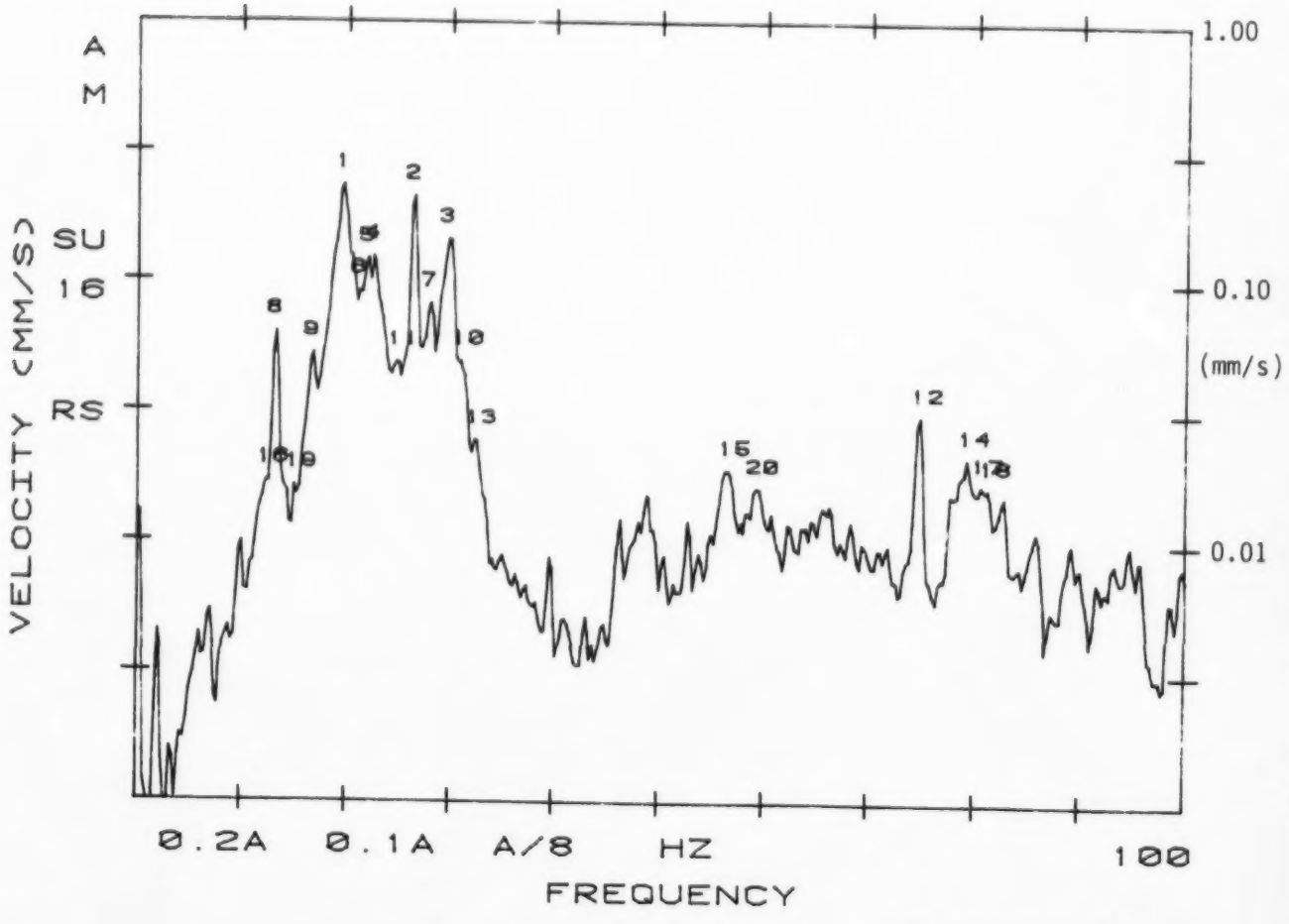

FIGURE D5
86-337

PICKERING NGS"B" UNIT#8
CCW PUMP#2 YE-1 (MOTOR)
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	19.5	.241
2	22.5	.1804
3	26.5	.1608
4	30	.135
5	13	.1036
6	74.5	.03701
7	.5	.03004
8	80	.02345
9	65.5	.0232
10	48.5	.02317
11	59.5	.02317
12	57.5	.02139
13	78.5	.02124
14	120	.02051
15	118.5	.01972
16	56.5	.01898
17	108	.01888
18	122.5	.01835
19	83.5	.01816
20	67.5	.01801

83.6-03 V/EA 1.00+00 E VLG

C

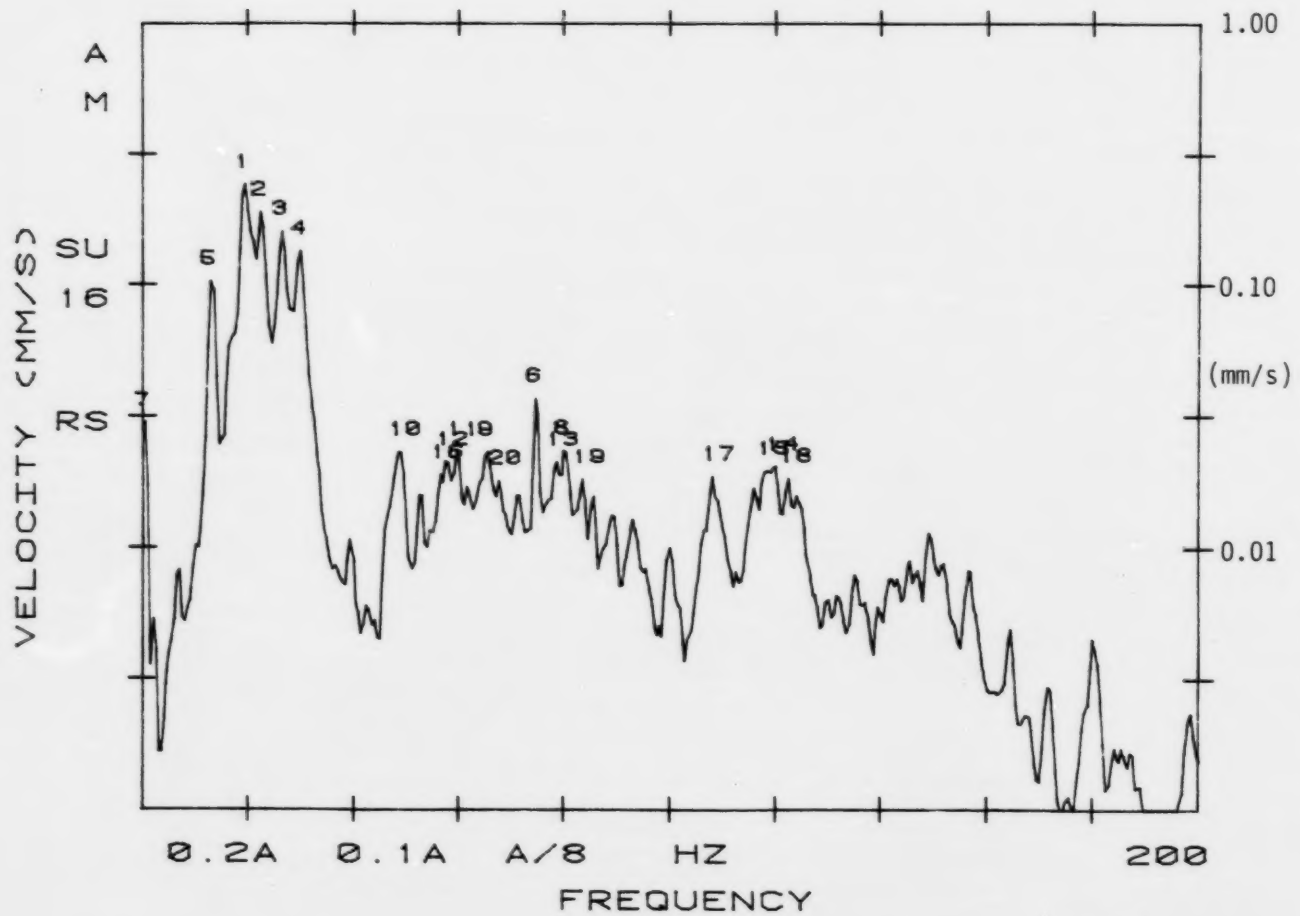

FIGURE D6
86-333

PICKERING NGS"B" UNIT#8
CCW PUMP#2 YE-2 (MOTOR)
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	74.75	.00355
2	30	.0607000000
3	43	.03766
4	26.5	.03041
5	46.25	.02932
6	32.25	.02908
7	10.75	.02725
8	39.75	.02456
9	23.25	.02023
10	27.75	.01722
11	79.25	.01699
12	25.25	.01669
13	60	.01665
14	29	.01663
15	2	.01654
16	77.75	.01645
17	65.75	.01618
18	13.25	.01616
19	44.5	.01486
20	66.5	.01444

25.2-03 V/EA 1.00+00 E VLG

C

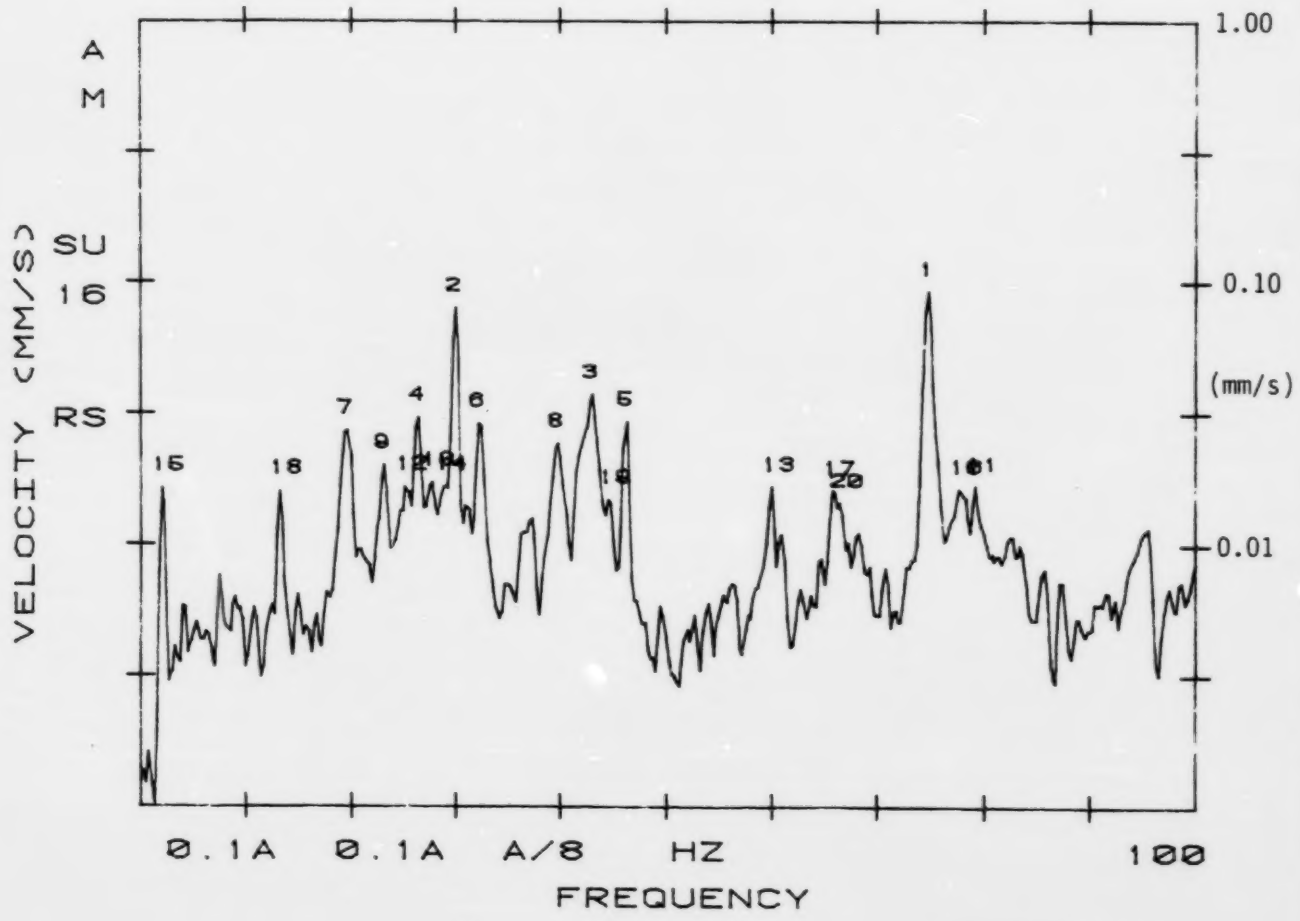

FIGURE D7
86-333

PICKERING NGS"B" UNIT#8
CCW PUMP#2 YE-2 (PUMP)
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	74.5	.1267
2	120	.1192
3	30	.08474
4	42.5	.05443
5	39.5	.04678
6	46	.02964
7	18.5	.02819
8	26.5	.02759
9	32.5	.02249
10	123	.0213
11	78.5	.02087
12	23.5	.0207
13	66.5	.01993
14	117	.01967
15	60	.01794
16	37	.01685
17	2	.01667
18	124.5	.01656
19	94	.01592
20	115.5	.01525

25.2-03 V/EA 1.00+00 E VLG

C

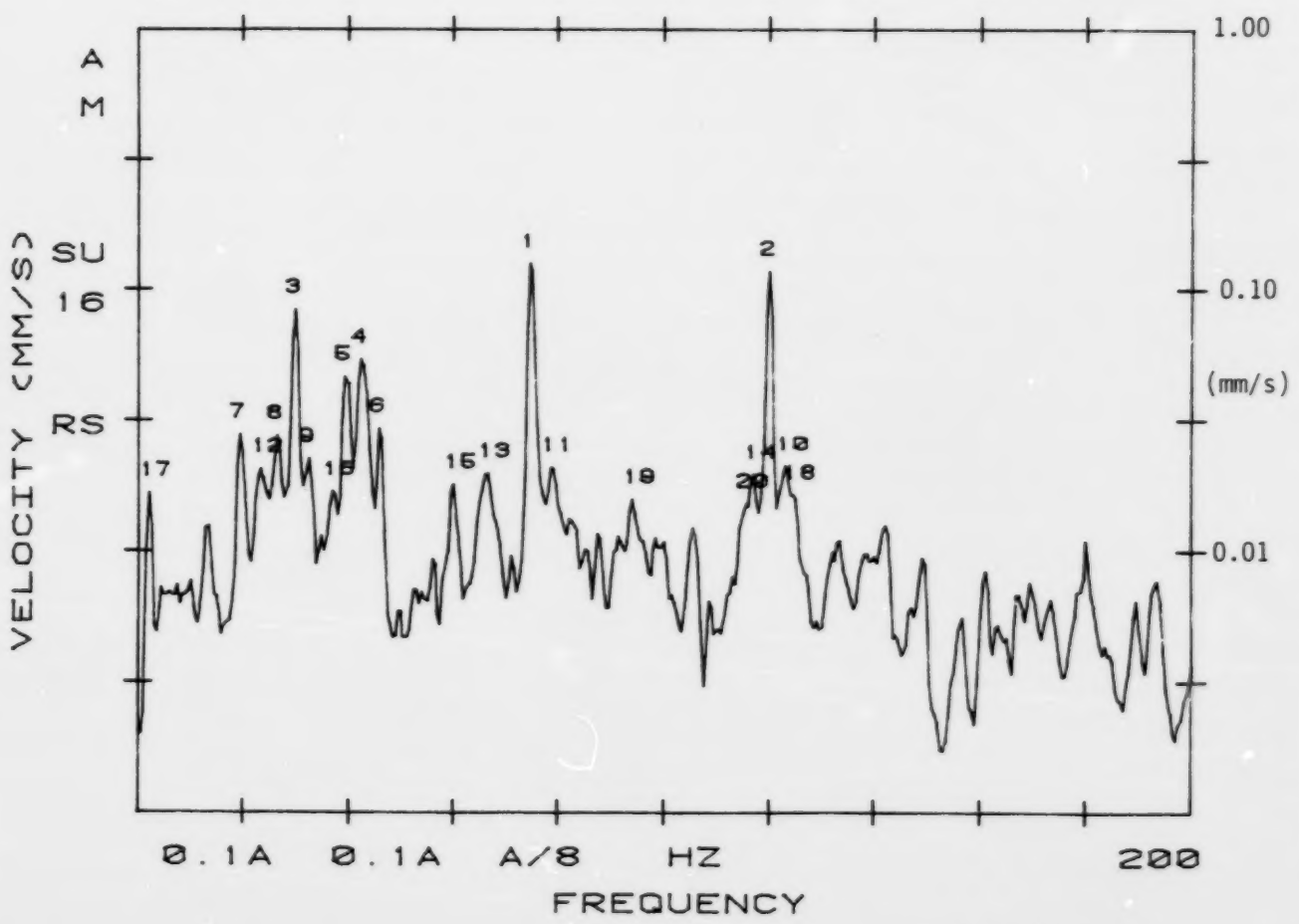

FIGURE D8
86-333

APPENDIX E

Log of Pumpset Vibration Taped Records at Full Unit Load

for Units 6, 7 and 8

DATE: 22-02-84

RECORDED BY: WM

APPENDIX E

PICKERING B UNIT #6 CCW PUMPSETS
TAPE RECORDS AT FULL LOAD 7.5 in/s

TR CH #	PUMP #	MEASUREMENT	TT	YMS AMP GAIN	
TAPE NAME #750411-10					
			0-155	Calibration. 3.54 Vrms at 100 Hz. TR attenuation 5:1.	
4	1	YE-2	645	L	3 min Record
5	1	YE-1	-745	M	
6	1	Ø			
7	2	YE-2		L	
8	2	YE-1		M	
9	2	Ø			

DATE: 28-01-86

RECORDED BY: WM

APPENDIX E

PICKERING B UNIT #7 CCW PUMPSETS
TAPE RECORDS AT FULL LOAD 7.5 in/s

TR CH #	PUMP #	MEASUREMENT	TT	YMS AMP GAIN	
TAPE NAME "Pickering B Unit #7 Full Load Records"					
			0-125	Calibration. 3.54 Vrms at 100 Hz. TR attenuation 5:1.	
9	1	YE-2	480	L	3 min Record
10	1	YE-1	-595	M	
11	2	YE-2		L	
12	2	YE-1		M	

DATE: 23-07-86

RECORDED BY: WM

APPENDIX E

PICKERING B UNIT #8 CCW PUMPSETS
TAPE RECORDS AT FULL LOAD 7.5 in/s

TR CH #	PUMP #	MEASUREMENT	TT	YMS AMP GAIN	
TAPE NAME "Pickering B Unit #8 Full Load Recordings"					
			0-125	Calibration. 3.54 Vrms at 100 Hz. TR attenuation 5:1.	
1	1	YE-2	1015	L	3 min Record
2	1	YE-1	-1135	M	
3	1	Ø			
4	2	YE-2		L	
5	2	YE-1		M	
6	2	Ø			

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